



Delhi Public School, Gandhinagar

Academic Session-2021-22

CLASS 9

SCIENCE

CHAPTER-4

STRUCTURE OF THE ATOM

Pg.No.43

Q.1 **What are canal rays?**

A.1 Canal rays are positively charged radiations. These rays consist of positively charged particles known as protons. They were discovered by Goldstein in 1886.

Q.2 **If an atom contains one electron and one proton, will it carry any charge or not?**

A.2 An electron is a negatively charged particle, whereas a proton is a positively charged particle.

The magnitude of their charges is equal. Therefore, an atom containing one electron and one proton will not carry any charge. Thus, it will be a neutral atom.

Pg.No.49 A

Q.1 **On the basis of Thomson's model of an atom, explain how the atom is neutral as a whole.**

A.1 According to Thomson's model of the atom, an atom consists of both negatively and positively charged particles. The negatively charged particles are embedded in the positively charged sphere.

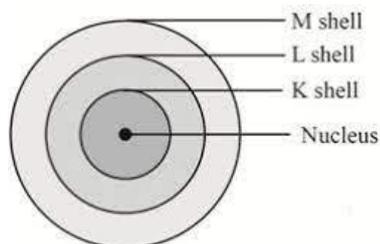
These negative and positive charges are equal in magnitude. Thus, by counterbalancing each other's effect, they make an atom neutral.

Q.2 **On the basis of Rutherford's model of an atom, which subatomic particle is present in the nucleus of an atom?**

A.2 On the basis of Rutherford's model of an atom, protons (positively-charged particles) are present in the nucleus of an atom.

Q.3 **Draw a sketch of Bohr's model of an atom with three shells.**

A.3



Q.4 **What do you think would be the observation if the α -particle scattering experiment is carried out using a foil of a metal other than gold?**

A.4 If the α -scattering experiment is carried out using a foil of a metal rather than gold, there would be no change in the observation. In the α -scattering experiment, a gold foil was taken because very thin foil for the experiment was required and gold is most malleable. This experiment was used to depict the structure of atoms.

Pg.No.49 B

Q.1 **Name the three sub-atomic particles of an atom. (to be discussed in class)**

A.1 The three sub-atomic particles of an atom are:

(i) Protons (ii) Electrons (iii) Neutrons

Q.2 **Helium atom has an atomic mass of 4 u and two protons in its nucleus. How many neutrons does it have?**

- A.2 Helium atom has two neutrons. The mass of an atom is the sum of the masses of protons and neutrons present in its nucleus.
Since helium atom has two protons, mass contributed by the two protons is $(2 \times 1) \text{ u} = 2\text{u}$.
Then, the remaining mass $(4 - 2) \text{ u} = 2 \text{ u}$ is contributed by 2 neutrons.

Pg.No.50

Q.1 **Write the distribution of electrons in carbon and sodium atoms?**

- A.1 The total number of electrons in a carbon atom is 6. The distribution of electrons in carbon atom is given by:

First orbit or K-shell = 2 electrons

Second orbit or L-shell = 4 electrons

The total number of electrons in a sodium atom is 11. The distribution of electrons in sodium atom is given by:

First orbit or K-shell = 2 electrons

Second orbit or L-shell = 8 electrons

Third orbit or M-shell = 1 electron

Q.2 **If K and L shells of an atom are full, then what would be the total number of electrons in the atom?**

- A.2 The maximum number of electrons that can occupy K and L-shells of an atom are 2 and 8 respectively. Therefore, if K and L-shells of an atom are full, then the total number of electrons in the atom would be $(2 + 8) = 10$ electrons.

Pg.No.52 A

Q.1 **How will you find the valency of chlorine, sulphur and magnesium?**

- A.1 If the number of electrons in the outermost shell of the atom of an element is less than or equal to 4, then the valency of the element is equal to the number of electrons in the outermost shell.

On the other hand, if the number of electrons in the outermost shell of the atom of an element is greater than 4, then the valency of that element is determined by subtracting the number of electrons in the outermost shell from 8.

The distribution of electrons in chlorine, sulphur, and magnesium atoms are 2, 8, 7; 2, 8, 6 and 2, 8, 2 respectively. Therefore, the number of electrons in the outer most shell of chlorine, sulphur, and magnesium atoms are 7, 6, and 2 respectively.

Thus,

The valency of chlorine = $8 - 7 = 1$

The valency of sulphur = $8 - 6 = 2$

The valency of magnesium = 2

Pg.No.52 B

Q.1 **If number of electrons in an atom is 8 and number of protons is also 8, then**

(i) what is the atomic number of the atom? and

(ii) what is the charge on the atom?

- A.1 (i) The atomic number is equal to the number of protons. Therefore, the atomic number of the atom is 8.
(ii) Since the number of both electrons and protons is equal, therefore, the charge on the atom is 0.

Q.2 **With the help of Table 4.1, find out the mass number of oxygen and sulphur atom.**

- A.2 Mass number of oxygen = Number of protons + Number of neutrons
 $= 8 + 8$
 $= 16$

Mass number of sulphur = Number of protons + Number of neutrons
 $= 16 + 16$
 $= 32$

Pg.No.53

Q.1 For the symbol H, D and T tabulate three sub - atomic particles found each of them.

A.1

Symbol	No. of electrons	No. of protons	No. of neutrons
H (Hydrogen)	1	1	0
D (Deuterium)	1	1	1
T (Tritium)	1	1	2

Q.2 Write the electronic configuration of any pair of isotopes and isobars.

A.2

Two isotopes of carbon are $^{12}_6C$ and $^{14}_6C$.

The electronic configuration of $^{12}_6C$ is 2, 4.

The electronic configuration of is $^{14}_6C$ 2, 4.

[Isotopes have same electronic configuration]

$^{40}_{29}Ca$ and $^{40}_{18}Ar$ are a pair of isobars

The electronic configuration of $^{40}_{29}Ca$ is 2, 8, 8, 2

The electronic configuration of $^{40}_{18}Ar$ is 2, 8, 8.

[Isobars have different electronic configuration]

Exercise:

Q.1

Compare the properties of electrons, protons and neutrons.

Characteristics	Electron	Proton	Neutron
(i) Location	Electrons are present outside the nucleus of an atom.	Protons are present in the nucleus of an atom.	Neutrons are present in the nucleus of an atom.
(ii) Charge	Electrons are negatively charged	Protons are positively charged.	Neutrons are neutral.
(iii) Mass	The mass of an electron is considered to negligible.	The mass of a proton is approximately 2000 times as the mass of an electron	The mass of neutron is nearly equal to the mass of a proton.
(iv) Discovered by:	J.J Thomson	E. Goldstein	J. Chadwick

Q.2

What are the limitations of J.J. Thomson's model of the atom?

A.2

According to J.J. Thomson's model of an atom, an atom consists of a positively charged sphere with electrons embedded in it. However, it was later found from Rutherford's experiment that the positively charged particles reside at the centre of the atom called the nucleus, and the electrons revolve around the nucleus.

Q.3

What are the limitations of Rutherford's model of the atom?

A.3

According to Rutherford's model of an atom, electrons revolve around the nucleus in fixed orbits. But, an electron revolving in circular orbits will not be stable because during revolution, it will experience acceleration. Due to acceleration, the electrons will lose energy in the form of radiation and fall into the nucleus. In such a case, the atom would be highly unstable and collapse.

Q.4

Describe Bohr's model of the atom.

A.4

Bohr's model of the atom: Niels Bohr proposed the following postulates regarding the model of the atom.

(i) Only certain orbits known as discrete orbits of electrons are allowed inside the atom.

(ii) While revolving in these discrete orbits, the electrons do not radiate energy. These discrete orbits or shells are represented by K,L,M...

The first orbit (i.e., for $n = 1$) is represented by letter K. Similarly, for $n = 2$, it is L shell, for $n = 3$, it is M shell and for $n = 4$, it is N shell. These orbits or shells are also called energy levels.

Q.5 Compare all the proposed models of an atom given in this chapter.

A.5 Covered in previous questions.

Q.6 Summarize the rules for writing of distribution of electrons in various shells for the first eighteen elements.

A.6 The rules for writing of the distribution of electrons in various shells for the first eighteen elements are given below:

(i) The maximum number of electrons that a shell can accommodate is given by the formula $2n^2$ where 'n' is the orbit number or energy level index ($n = 1, 2, 3...$).

The maximum number of electrons present in an orbit of $n = 1$ given by

$$\begin{aligned}2n^2 &= 2 \times 1 \\ &= 2\end{aligned}$$

Similarly, for second orbit, it is $2n^2 = 2 \times 2^2$
 $= 8$

For third orbit, it is $2n^2 = 2 \times 3^2$
 $= 18$

And so on

(ii) The outermost orbit can be accommodated by a maximum number of 8 electrons.

(iii) Shells are filled with electrons in a step wise manner i.e., the outer shell is not occupied with electrons unless the inner shells are completely filled with electrons.

Q.7 Define valency by taking examples of silicon and oxygen.

A.7 The valency of an element is the combining capacity of that element. For example, the atom of silicon has four valence electrons. Thus, the valency of silicon is four. On the other hand, if the number of valence electrons of the atom of an element is greater than four, then the valency of that element is obtained by subtracting the number of valence electrons from eight. For example, the atom of oxygen has six valence electrons.

Thus, the valency of oxygen is $(8 - 6)$ i.e., two.

Q.8 Explain with examples

(i) Atomic number,

(ii) Mass number,

(iii) Isotopes and

(iv) Isobars.

Give any two uses of isotopes.

A.8 (i) Atomic number

The atomic number of an element is the total number of protons present in the atom of that element.

For example, nitrogen has 7 protons in its atom. Thus, the atomic number of nitrogen is 7.

(ii) Mass number

The mass number of an element is the sum of the number of protons and neutrons present in the atom of that element. For example, the atom of boron has 5 protons and 6 neutrons. So, the mass number of boron is $5 + 6 = 11$.

(iii) Isotopes

They are atoms of the same element and have same atomic number but different mass number/atomic mass. For example: Carbon

(iv) Isobars

They are atoms of different elements having same mass number but different atomic number.

For example, calcium, atomic number 20 and argon, atomic number 18.

The number of electrons in these atoms is different, but the mass number of both these elements is 40.

Two uses of isotopes are as follows:

(i) An isotope of uranium is used as a fuel in nuclear reactors.

(ii) An isotope of cobalt is used in the treatment of cancer.

Q.9 **Na⁺ has completely filled K and L shells. Explain.**

A.9 Na has atomic number 11, so its electronic configuration is = 2, 8, 1

When it gives away its outermost shell single electron it changes to Na⁺ = 10 = 2, 8

The above configuration indicates completely filled K, L shells.

Q.10 **If bromine atom is available in the form of, say, two isotopes $^{79}_{35}\text{Br}$ (49.7%) and $^{81}_{35}\text{Br}$ (50.3%), calculate the average atomic mass of bromine atom.**

A.10 The average atomic mass of bromine

$$= (79 \times 49.7) + (81 \times 50.3)/100$$

$$= (3926.3 + 4074.3)/100$$

$$= 8000.6/100$$

$$= 80 \text{ u}$$

Q.11 **The average atomic mass of a sample of an element X is 16.2 u. What are the percentages of isotopes $^{16}_8\text{X}$ and $^{18}_8\text{X}$ in the sample?**

A.11 Let the mass percentage of isotope $^{16}_8\text{X}$ be P. Therefore, the mass percentage of isotope $^{18}_8\text{X}$ will be = 100 - P

Since average atomic mass = 16.2u

$$16.2 = 16 \times P + 18 \times (100 - P)/100$$

$$16.2 = 16P + 1800 - 18P/100$$

$$1620 = -2P + 1800$$

$$2P = 1800 - 1620$$

$$P = 180/2 = 90$$

When 90% is the X-16 sample so for X-18 sample % = 100 - 90 = 10%

Q.12 **If Z = 3, what would be the valency of the element? Also, name the element.**

A.12 By Z = 3, we mean that the atomic number of the element is 3. Its electronic configuration is 2, 1.

Hence, the valency of the element is 1 (since the outermost shell has only one electron).

Therefore, the element with Z = 3 is lithium.

Q.13 **Composition of the nuclei of two atomic species X and Y are given as under**

X Y

Protons = 6 6

Neutrons = 6 8

Give the mass numbers of X and Y. What is the relation between the two species?

A.13 Mass number of X = Number of protons + Number of neutrons

$$= 6 + 6$$

$$= 12$$

Mass number of Y = Number of protons + Number of neutrons

$$= 6 + 8$$

$$= 14$$

These two atomic species X and Y have the same atomic number, but different mass numbers.

Hence, they are isotopes.

Q.14 For the following statements, write T for 'True' and F for 'False'.

(a) J.J. Thomson proposed that the nucleus of an atom contains only nucleons.

- (b) A neutron is formed by an electron and a proton combining together. Therefore, it is neutral.
- (c) The mass of an electron is about 1/2000 times that of proton.
- (d) An isotope of iodine is used for making tincture iodine, which is used as a medicine.
- A.14 (a) J.J. Thomson proposed that the nucleus of an atom contains only nucleons. (F)
- (b) A neutron is formed by an electron and a proton combining together. Therefore, it is neutral. (F)
- (c) The mass of an electron is about 1/2000 times that of proton. (T)
- (d) An isotope of iodine is used for making tincture iodine, which is used as a medicine. (T)
- Q.15 Put tick (✓) against correct choice and cross (x) against wrong choice in the following question: Rutherford's alpha-particle scattering experiment was responsible for the discovery of
- (a) Atomic nucleus
- (b) Electron
- (c) Proton
- (d) Neutron
- A.15 (a) Atomic nucleus
- Q.16 Put tick (✓) against correct choice and cross (x) against wrong choice in the following question: Isotopes of an element have
- (a) the same physical properties
- (b) different chemical properties
- (c) different number of neutrons
- (d) different atomic numbers
- A.16 (c) different number of neutrons
- Q.17 Put tick (✓) against correct choice and cross (x) against wrong choice in the following question: Number of valence electrons in Cl^- ion are:
- (a) 16
- (b) 8
- (c) 17
- (d) 18
- A.17 (b) 8
- Q.18 Which one of the following is a correct electronic configuration of sodium?
- (a) 2, 8
- (b) 8, 2, 1
- (c) 2, 1, 8
- (d) 2, 8, 1
- A.18 (d) The correct electronic configuration of sodium is 2, 8, 1.

Class: IX

Subject: Science

Lesson Name: Structure of The Atom

Extra Questions-2021-22

- Q.1** How many electrons are present in a cation of an element having valency 3, if the mass number of the atom is 27 and the number of neutrons is 14?
- Q.2** Show diagrammatically the electron distribution for following:
- a) Sodium and Sodium ion.
 - b) Magnesium and Magnesium ion.
- Q.3** Write three points of difference between Isotopes and Isobars.
- Q.4** ${}^{24}_{12}\text{Mg}$ and ${}^{26}_{12}\text{Mg}$ are symbols of two isotopes of magnesium. Compare these isotopes with respect to:
- a) Composition of the nuclei.
 - b) Electronic configuration and valency.
 - c) Chemical properties.
 - d) Physical properties.
- Q.5** What are nucleons? What is the name given to those atoms which have same number of nucleons in it?

CHAPTER-13

WHY DO WE FALL ILL?

Intext Questions: Pg. No. 178

Q.1 State any two conditions essential for good health.

Ans Two conditions essential for good health are:

- Better sanitation or clean surroundings, and
- Availability of sufficient and nutritious food.

Q.2 State any two conditions essential for being free of disease.

Ans Two conditions essential for being free of disease:

- Living in hygienic environment
- Getting vaccinated against common infectious diseases.

Q.3 Are the answers to the above questions necessarily the same or different? Why? (To be discussed/marked)

Ans Answers of above question (1, 2) are interconnected but different. It is because being disease free does mean being healthy.

Intext Questions: Pg. No. 180

Q.1 List any three reasons why you would think that you are sick and ought to see a doctor. If only one of these symptoms were present, would you still go to the doctor? Why or why not? (To be discussed/marked)

Ans If we have fever, headache, stomach-ache, loose motions, cough and sneeze etc we feel weak. Then we would feel that we are sick and ought to see a doctor. If only one of these symptoms is present, we should still go to see the doctor. Any of these symptoms may be initial signs of a severe disease.

Q.2 In which of the following case do you think the long-term effects on your health are likely to be most unpleasant?

- if you get jaundice,
- if you get lice,
- if you get acne. Why?

Ans The long-term effects on our health are likely to be most unpleasant if we get jaundice because the symptoms severely affect our internal organs and persist for long time. In contrast to jaundice, lice can be removed easily with short treatment and so is the acne. Both of these do not produce long term effects on the body.

Intext Questions: Pg. No. 187

Q.1 Why we are normally advised to take bland and nourishing food when we are sick?

Ans We are normally advised to take bland and nourishing food when we are sick because we are weak during illness and need complete nourishment for faster recovery. Such a food is easily digested and replenishes our lost vitamins, minerals and other nutrients along with energy.

Q.2 What are the different means by which infectious diseases are spread?

Ans Infectious diseases can be spread by following means:

(i) **Direct Transmission**

a) Direct contact

- b) Contact with soil
- c) Through animal bites
- d) Transplacental transmission

(ii) Indirect Transmission

- a) Through contaminated food and water
- b) Through air
- c) Through vectors or carriers (housefly, mosquito etc)
- d) Through fomites

Q.3 What precautions can you take in your school to reduce the incidence of infectious diseases? (To be discussed/marked)

Ans To reduce the incidence of infectious diseases in my school the precautions will include:

- (i) Washing our hands properly before eating.
- (ii) Avoiding coming to school when one is affected with a communicable disease.
- (iii) Using a handkerchief while sneezing or coughing.
- (iv) Vaccinating oneself before the infection starts.
- (v) Educating students about causes of infectious diseases
- (vi) Proper sanitation or clean environment in school and its surroundings to eradicate vectors of infectious diseases.

Q.4 What is immunisation?

Ans Immunisation is defined as protection of the body from communicable diseases by administration of a particular vaccine to develop immunity against a particular disease.

The vaccine contains weakened form of original pathogens that stimulates the immune system the body.

Q.5 What are the immunisation programs available at the nearest health centre in your locality? Which of these diseases are the major health problems in your area? (to be discussed/marked)

Ans DPT vaccine: it is for diphtheria, whooping cough and tetanus in infants.

Pulse polio vaccine: it is to prevent polio.

BCG vaccine: Bacillus Calmette Guerin vaccine for tuberculosis.

Hepatitis vaccine

TAB vaccine for typhoid.

H1N1 vaccination

Tuberculosis and diarrhoea are the major health problems in our area.

Exercise Questions: Pg. No.187-188

Q.1 How many times did you fall ill in the last one year? What were the illnesses?

(a) Think of one change you could make in your habits in order to avoid any of/most of the above illnesses.

(b) Think of one change you would wish for in your surroundings in order to avoid any of/most of the above illnesses. (To be discussed/marked)

Ans I fall ill only once last year. I had suffered from typhoid.

(a) I will avoid street food specially those which are cooked at unhygienic places and kept uncovered.

(b) I shall keep my surroundings cleaner than earlier.

Q.2 A doctor/nurse/health-worker is exposed to more sick people than others in the community. Find out how she/he avoids getting sick herself/himself.

A doctor/nurse/health personnel always keep their nose and mouth covered; they wear gloves and cover their bodies with coats, when dealing with sick people. They get immunized to prevent infectious diseases. They also wash hands with soaps thoroughly after serious examination of patients.

Q.3 Conduct a survey in your neighbourhood to find out what the three most common diseases are. Suggest three steps that could be taken by your local authorities to bring down the incidence of these diseases.

Ans Three most common diseases in my locality are diarrhoea, malaria and tuberculosis and following steps I would suggest to be taken by our local authorities to bring down the incidence of these diseases:

- i.) Supply of safe drinking water and preventing incidences of open drains.
- ii) Improved and hygienic environment, free of garbage and wastes thrown in the open.
- iii) Eradication of mosquitoes.
- iv) Immunisation/vaccination camps

Q.4 A baby is not able to tell her/his caretakers that she/he is sick. What would help us to find out-

- (a) That the baby is sick?**
- (b) What is the sickness? (to be discussed/marked)**

Ans (a) Symptoms that help us to find that baby is sick, are:

- (i) continuous crying and restlessness in the child
- (ii) improper intake of food and body temperature
- (iii) loose motions

(b) Baby is suffering from diarrhoea

Q.5 Under which of the following conditions is a person most likely to fall sick?

- (a) When she is recovering from malaria.**
- (b) When she has recovered from malaria and is taking care of someone suffering from chicken-pox.**
- (c) When she is on a four-day fast after recovering from malaria and is taking care of someone suffering from chicken-pox. Why?**

Ans A person is most likely to fall sick when she is on a four-day fast after recovering from malaria and is taking care of someone suffering from chicken-pox because a four day fast will make her body weak due to improper supply of food. Also, malaria is a very fatal disease and it will take some time for the body organs to function normally. Above all, she is taking care of someone who is suffering from most fearful infectious viral disease i.e., chicken pox, she has more chances of getting an infection due to above mentioned reasons.

Q.6 Under which of the following conditions are you most likely to fall sick?

- (a) When you are taking examinations.**
- (b) When you have travelled by bus and train for two days.**
- (c) When your friend is suffering from measles. Why?**

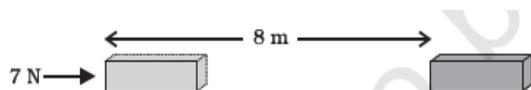
Ans We are most likely to fall sick when a friend is suffering from measles since measles is an infectious/communicable disease that can spread easily from one person to the other.

CLASS:IX SCIENCE(PHYSICS)

CHAPTER-11 WORK AND ENERGY

Page No. 148

- 1 A force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force (Fig. 11.3). Let us take it that the force acts on the object through the displacement. What is the work done in this case?



- A When a force F acts on an object to displace it through a distance s in its direction, then the work done W on the object by the force is given by:

Work done = Force \times Displacement

$$W = F \times s$$

Given: Force, $F = 7 \text{ N}$, Displacement, $s = 8 \text{ m}$

Therefore, work done is, $W = F \times s = 7 \text{ N} \times 8 \text{ m} = 56 \text{ Nm} = 56 \text{ J}$

Page No.149

- 1 **When do we say that work is done?**

- A Work is done whenever the given conditions are satisfied:

- (i) A force acts on a body.
- (ii) There is a displacement of the body.

- 2 **Write an expression for the work done when a force is acting on an object in the direction of its displacement.**

- A When a force F displaces a body through a distance s in the direction of the applied force, then the work done on the body is given by the expression:

$$\text{Work done}(W) = \text{Force}(F) \times \text{Displacement}(s) = (F \cos \theta) \times s$$

- 3 **Define 1 J of work.**

- A 1 J is the amount of work done by a force of 1 N on an object to displace it through a distance of 1m in its own direction.

- 4 **A pair of bullocks exerts a force of 140 N on a plough. The field being ploughed is 15 m long. How much work is done in ploughing the length of the field?**

- A Work done by the bullocks is given by the expression: $W = (F \cos \theta) \times s = F \times s$ (in case maximum work)

Where, Applied force, $F = 140 \text{ N}$, Displacement, $s = 15 \text{ m}$

$$W = 140 \times 15 = 2100 \text{ J}$$

Hence, 2100 J of work is done in ploughing the length of the field.

Page No.152

- 1 **What is the kinetic energy of an object?**

- A Kinetic energy is the energy possessed by a body by the virtue of its motion. Every moving body possesses kinetic energy.

- 2 **Write an expression for the kinetic energy of an object.**

- A If an object of mass m is moving with a velocity v , then its kinetic energy E_k is given by the expression,

$$E_k = \frac{1}{2} m v^2$$

- 3 **The kinetic energy of an object of mass, m moving with a velocity of 5 m/s is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times?**

- A Given that $m =$ Mass of the object, $v =$ Velocity of the object $= 5 \text{ ms}^{-1}$ and Kinetic energy, $E_k = 25 \text{ J}$

Expression for kinetic energy is $E_k = \frac{1}{2} mv^2$

$E_k \propto v^2$ (as m is constant)

(i) If the velocity of an object is doubled, then its kinetic energy becomes 4 times the original value, because it is proportional to the square of the velocity. Hence, kinetic energy = $25 \times 4 = 100$ J.

(ii) If velocity is increased three times, then its kinetic energy becomes 9 times the original value, because it is proportional to the square of the velocity. Hence, kinetic energy = $25 \times 9 = 225$ J.

Page No.156

1 **What is power?**

A Power is the rate of doing work or the rate of transfer of energy. If W is the amount of work done in time t, then power is given by the expression, Power, $P = \text{Work}/\text{time} = W/t$

2 **Define 1 watt of power.**

A body is said to have power of 1 watt if it does work at the rate of 1 joule per second, i.e.,

$$1 \text{ watt} = \frac{1 \text{ joule}}{1 \text{ second}}$$

3 **A lamp consumes 1000 J of electrical energy in 10 s. What is its power?**

Power is given by the expression,

$$\text{Power} = \frac{\text{Work done}}{\text{Time}}$$

Work done = Energy consumed by the lamp = 1000 J

Time = 10 s

$$\text{Power} = \frac{1000}{10} = 100 \text{ J/s} = 100 \text{ W}$$

4 **Define average power.**

Average power is obtained by dividing the total amount of work done by the total time taken to do the work.

$$\text{Average Power} = \frac{\text{Total work done}}{\text{Total time taken}}$$

The concept of average power is used when the power of an agent varies with time i.e. it does work at different rates during different intervals of time.

EXERCISE QUESTIONS

Page No.158

1 **Look at the activities listed below. Reason out whether or not work is done in the light of your understanding of the term 'work'.**

Suma is swimming in a pond.

- Suma is swimming in a pond.**
- A donkey is carrying a load on its back.**
- A wind-mill is lifting water from a well.**
- A green plant is carrying out photosynthesis.**
- An engine is pulling a train.**
- Food grains are getting dried in the sun.**
- A sailboat is moving due to wind energy.**

A a) While swimming, Suma applies a force to push the water backwards. Therefore, Suma swims in the forward direction caused by the forward reaction of water. Here, the force causes a displacement. Hence, work is done by Seema while swimming.

b) While carrying a load, the donkey has to apply a force in the upward direction. But, displacement of

the load is in the forward direction. Since, displacement is perpendicular to force, the work done is zero.

- c) A wind mill works against the gravitational force to lift water. Hence, work is done by the wind mill in lifting water from the well.
- d) In this case, there is no displacement of the leaves of the plant. Therefore, the work done is zero.
- e) An engine applies force to pull the train. This allows the train to move in the direction of force. Therefore, there is a displacement in the train in the same direction. Hence, work is done by the engine on the train.
- f) Food grains do not move in the presence of solar energy. Hence, the work done is zero during the process of food grains getting dried in the Sun.
- g) Wind energy applies a force on the sailboat to push it in the forward direction. Therefore, there is a displacement in the boat in the direction of force. Hence, work is done by wind on the boat.

2 **An object thrown at a certain angle to the ground moves in a curved path and falls back to the ground. The initial and the final points of the path of the object lie on the same horizontal line. What is the work done by the force of gravity on the object?**

A Work done by the force of gravity on an object depends on vertical displacement. Vertical displacement is given by the difference between the initial and final heights of the object, which is zero. Work done by gravity is given by the expression, $W = mgh = mg \times 0 = 0 \text{ J}$
Therefore, the work done by gravity on the given object is zero.

3 **A battery lights a bulb. Describe the energy changes involved in the process.**

A When a bulb is connected to a battery, then the chemical energy of the battery is transferred into electrical energy. When the bulb receives this electrical energy, then it converts it into light and heat energy. Hence, the transformation of energy in the given situation can be shown as:
Chemical Energy \rightarrow Electrical Energy \rightarrow Light Energy + Heat Energy

4 **Certain force acting on a 20 kg mass changes its velocity from 5 m/s to 2 m/s. Calculate the work done by the force.**

A Mass of the body, $m = 20 \text{ kg}$, Initial velocity, $u = 5 \text{ m/s}$, Final velocity, $v = 2 \text{ m/s}$
Initial kinetic energy of the body,

$$E_{ki} = \frac{1}{2}mu^2 = \frac{1}{2} \times 20 \times (5)^2 = 250 \text{ J}$$

Final kinetic energy of the body,

$$E_{kf} = \frac{1}{2}mv^2 = \frac{1}{2} \times 20 \times (2)^2 = 40 \text{ J}$$

Work done by the force = Change in kinetic energy = $E_{kf} - E_{ki} = 40 \text{ J} - 250 \text{ J} = -210 \text{ J}$

Work done is negative because force is applied in the direction opposite to that of displacement.

5 **A mass of 10 kg is at a point A on a table. It is moved to a point B. If the line joining A and B is horizontal, what is the work done on the object by the gravitational force? Explain your answer.**

A Work done on the object by the gravitational force is zero. This is because the force of gravity and displacement of the body are at right angles to each other.

6 **The potential energy of a freely falling object decreases progressively. Does this violate the law of conservation of energy? Why?**

A No, the process does not violate the law of conservation of energy. This is because when the body falls from a height, then its potential energy changes into kinetic energy progressively. A decrease in the potential energy is equal to an increase in the kinetic energy of the body. During the process, total mechanical energy of the body remains conserved. Therefore, the law of conservation of energy holds good.

7 **What are the various energy transformations that occur when you are riding a bicycle?**

A Muscular Energy → Rotation Kinetic Energy → Linear Kinetic Energy

8 **Does the transfer of energy take place when you push a huge rock with all your might and fail to move it? Where is the energy you spend going?**

A When we push a huge rock and fail to move it, the energy spent by us gets stored in the rock as potential energy of configuration which results in its deformation. However, this deformation in the rock is so small that it cannot be observed by us.

9 **A certain household has consumed 250 units of energy during a month. How much energy is this in joules?**

A 1 unit of energy is equal to 1 kilowatt hour (kWh). Hence, 1 unit = 1 kWh

Also, $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$

Therefore, 250 units of energy = $250 \times 3.6 \times 10^6 = 9 \times 10^8 \text{ J}$

10 **An object of mass 40 kg is raised to a height of 5 m above the ground. What is its potential energy? If the object is allowed to fall, find its kinetic energy when it is half-way down.**

A Gravitational potential energy is given by the expression, $W = m g h$

$h = 5 \text{ m}$, $m = 40 \text{ kg}$, $g = 9.8 \text{ ms}^{-2}$

$W = 40 \times 5 \times 9.8 = 1960 \text{ J}$.

At half-way down, the potential energy of the object will be $1960/2 = 980 \text{ J}$.

At this point, the object has an equal amount of potential and kinetic energy. This is due to the law of conservation of energy. Hence, half-way down, the kinetic energy of the object will also be 980 J.

11 **What is the work done by the force of gravity on a satellite moving round the earth? Justify your answer.**

A When a satellite moves round the Earth, then at each point of its path, the direction of force of gravity on the satellite (along the radius) is perpendicular to the direction of its displacement (along the tangent). Hence, the work done on the satellite by the force of gravity is zero.

12 **Can there be displacement of an object in the absence of any force acting on it? Think. Discuss this question with your friends and teacher.**

A Yes. This is possible for an object undergoing uniform motion along a straight line.

We know, $F = ma$

If $F = 0$, then $m \times a = 0$

But m cannot be zero, so $a=0$.

In such a case, the object is either at rest or moving with constant velocity (i.e. uniform motion along a straight line).

Therefore, when the object moves with constant velocity, there is a displacement of the object without any force acting on it.

Page No.159

13 **A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? Justify your answer.**

A When a person holds a bundle of hay over his head, then there is no displacement of the bundle at all. So, no work is done by him. However, the person gets tired due to the muscular fatigue experienced by him.

14 **An electric heater is rated 1500 W. How much energy does it use in 10 hours?**

A Energy consumed by an electric heater can be obtained with the help of the expression,

$$P = \frac{W}{t}$$

where, Power rating of the heater, $P = 1500 \text{ W} = 1.5 \text{ kW}$

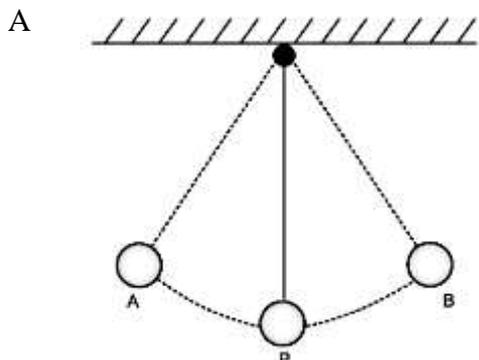
Time for which the heater has operated, $t = 10 \text{ h}$

Work done = Energy consumed by the heater

Therefore, energy consumed = Power \times Time = $1.5 \times 10 = 15$ kWh

Hence, the energy consumed by the heater in 10 h is 15 kWh or 15 units.

- 15 **Illustrate the law of conservation of energy by discussing the energy changes which occur when we draw a pendulum bob to one side and allow it to oscillate. Why do the bob eventually come to rest? What happens to its energy eventually? Is it a violation of the law of conservation of energy?**



- When the bob of the pendulum is drawn from its mean position P to either of its extreme positions (say B), it rises through a height and gains potential energy.
 - When it is released from position B and starts moving towards position P, its potential energy keeps on decreasing and its kinetic energy keeps on increasing.
 - When the bob reaches position P, its kinetic energy becomes maximum and potential energy becomes zero.
 - Now, when the bob starts moving to the other extreme position A, its kinetic energy goes on decreasing and its potential energy goes on increasing.
 - At position A, all the kinetic energy gets converted to potential energy.
 - Hence, we conclude that at the extreme positions A and B, all the energy of the bob is potential and at the mean position P, all the energy is kinetic. At all other intermediate positions, the energy of the bob is partly potential and partly kinetic. But the total energy at any instant remains constant.
 - The bob does not oscillate forever. It eventually comes to rest due to air resistance and the friction at the point of support. The law of conservation of energy is not violated in this case because the energy of the bob gets converted into heat energy and sound energy which go into the surroundings.
- 16 **An object of mass, m is moving with a constant velocity, v . How much work should be done on the object in order to bring the object to rest?**

A Kinetic energy of an object of mass m moving with a velocity v is given by the expression $\frac{1}{2}mv^2$. To bring the object to rest, an equal amount of work i.e. $\frac{1}{2}mv^2$ is required to be done on the object.

- 17 **Calculate the work required to be done to stop a car of 1500 kg moving at a velocity of 60 km/h?**

A Mass of car, $m = 1500$ kg, Velocity of car, $v = 60$ km/h = $(60 \times 5)/18$ m/s

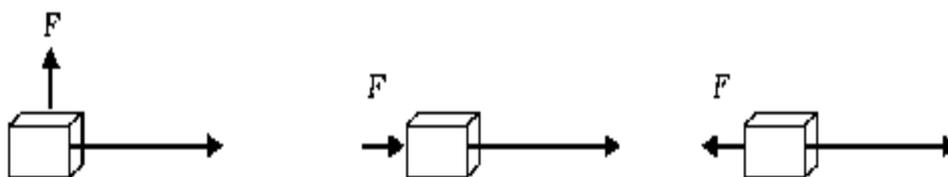
$$E_k = \frac{1}{2}mv^2$$

$$E_k = \frac{1}{2} \times 1500 \times \left(60 \times \frac{5}{18}\right)^2 = 20.8 \times 10^4 \text{ J}$$

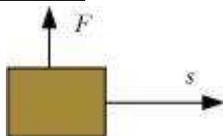
To stop the car, an amount of work equal to E_k is required to be done.

Hence, 20.8×10^4 J of work is required to stop the car.

- 18 **In each of the following a force, F is acting on an object of mass, m . The direction of displacement is from west to east shown by the longer arrow. Observe the diagrams carefully and state whether the work done by the force is negative, positive or zero.**

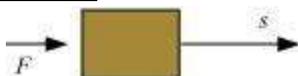


A **Case I**



In this case, the direction of force acting on the block is perpendicular to the direction of displacement. Therefore, work done by force on the block will be zero.

Case II



In this case, the direction of force acting on the block and the direction of displacement is same. Therefore, work done by force on the block will be positive.

Case III



In this case, the direction of force acting on the block is opposite to the direction of displacement. Therefore, work done by force on the block will be negative.

19 **Soni says that the acceleration in an object could be zero even when several forces are acting on it. Do you agree with her? Why?**

A Yes, acceleration in an object could be zero even when several forces are acting on it. This happens when all the forces cancel out each other i.e., the net force acting on the object is zero.

20 **Find the energy in kW h consumed in 10 hours by four devices of power 500 W each.**

A Power rating of each device, $P = 500 \text{ W} = 0.50 \text{ kW}$

Time for which each device runs, $t = 10 \text{ h}$

Work done = Energy consumed by each device (E)

We know, Power = Energy consumed/time

Energy consumed by each device = Power \times Time

$E = P \times t = 0.50 \times 10 = 5 \text{ kWh}$

Hence, the energy consumed by four devices of power 500 W each in 10 h will be

$4 \times 5 \text{ kWh} = 20 \text{ kWh} = 20 \text{ units}$

21 **A freely falling object eventually stops on reaching the ground. What happens to its kinetic energy?**

A As the object hits the hard ground, its kinetic energy gets converted into

- Heat energy (the object and the ground become slightly warm)
- Sound energy (sound is heard when the object hits the ground)
- Potential energy of configuration of the body and the ground (the object and the ground get deformed a little bit at the point of collision).

CLASS-IX- SCIENCE (PHYSICS)

CHAPTER-10 GRAVITATION

FOR FAIR NOTEBOOK WORK

In-text Questions

1) State the universal law of gravitation.[Page No.134]

- The law of gravitation states that the force of attraction between any two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

2) Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth. [Page No.134]

- Let the mass of earth = M.

Let the mass of the object = m.

Distance between the earth's centre and object's centre = Radius of the earth = R.

Therefore, Gravitational Force = $F = \frac{GmM}{R^2}$

3) What do you mean by free fall? [Page No.136]

- Any object that is being acted upon only by the force of gravity is said to be in a state of free fall.

4) What do you mean by acceleration due to gravity? [Page No.136]

- If an object falls freely towards the surface of earth from a certain height then its velocity changes at uniform rate. This change in velocity produces acceleration in the object which is known as acceleration due to gravity. The value of acceleration due to gravity is $g = 9.8 \text{ m/s}^2$.

5) What are the differences between the mass of an object and its weight? [Page No.138]

- Difference is given below:

Mass	Weight
It is the actual amount of material contained in a body.	It is the force exerted by the gravity on the body.
It is measured in kilogram, gram etc.	It is measured in newton.
It is denoted by m or M.	It is denoted by W.
It is always constant for body.	It varies from place to place for body.
It is a fundamental physical quantity.	It is a derived physical quantity.

6) Why is the weight of an object on the moon $\frac{1}{6}$ th its weight on the earth? [Page No.138]

- The earth's mass (M_e) is $6 \times 10^{24} \text{ kg}$

The moon's mass (M_m) is $7.4 \times 10^{22} \text{ kg}$

$$\therefore \frac{M_e}{M_m} = \frac{6 \times 10^{24}}{7.4 \times 10^{22}}$$

$$\therefore \frac{M_e}{M_m} = 0.81 \times 10^2 = 81$$

$$\therefore M_e = 81 M_m$$

The earth's radius (R_e) is 6.4×10^3 km

The moon's radius (R_m) is 1.7×10^3 km

$$\therefore \frac{R_e}{R_m} = \frac{6.4 \times 10^3}{1.7 \times 10^3}$$

$$\therefore \frac{R_e}{R_m} = 3.8$$

$$\therefore R_e = 3.8 R_m$$

$$g_e = \frac{GM_e}{R_e^2}$$

$$g_e = \frac{G \times 81M_m}{(3.8)^2 R_m^2}$$

$$g_e = \frac{81 \times GM_m}{14.4 R_m^2}$$

$$g_e = 5.6 g_m = 6 g_m (\text{Approx.}) \left(g_m = \frac{GM_m}{R_m^2} \right)$$

$$g_m = \frac{1}{6} g_e$$

$$mg_m = \frac{1}{6} mg_e$$

$$W_m = \frac{1}{6} W_e$$

Exercise: [Page No.143-144]

1) How does the force of gravitation between two objects change when the distance between them is reduced to half?

- According to Universal Law of gravitation, the gravitational force of attraction between any two objects of masses M and m be

$$F = \frac{GmM}{r^2}$$

And r be the distance between two masses

If the distance between them is halved, then new distance

$$r^1 = r/2$$

$$\text{New force } F' = \frac{GmM}{(r^1)^2}$$

$$F' = \frac{GmM}{(r/2)^2}$$

$$F' = 4 \frac{GmM}{r^2}$$

$$F' = 4F$$

When the distance between the masses is reduced to half, the gravitational force increases by 4 times than the original one.

2) Gravitational force acts on all objects in proportion to their masses. Why then, a heavy object does not fall faster than a light object?

➤ A heavy object falls faster than a light object in the presence of air resistance because the heavy body faces air resistance lesser than the light body but when we don't consider air resistance (vacuum) then both heavy and light object will reach to the ground at the same time. Also, all objects fall from height with constant acceleration called acceleration due to gravity.

3) What is the magnitude of the gravitational force between the earth and a 1 kg object on its surface? (Mass of the earth is 6×10^{24} kg and radius of the earth is 6.4×10^6 m.)

➤ $M = 6 \times 10^{24}$ kg

$m = 1$ kg

$R = 6.4 \times 10^6$ m

Gravitational force between earth and the object is given by -

$$F = \frac{GmM}{R^2}$$

$$F = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6.4 \times 10^6)^2}$$

$F = 9.77$ N = 9.8 N (Approx.)

Therefore, gravitational force between the earth and an object is 9.8 N.

4) The earth and the moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as the force with which the moon attracts the earth? Why?

➤ The value of F is same for earth and the moon. Both bodies will exert the same amount of force on each other. As per universal law of gravitation, everybody attracts the other body with some force and this force is same for both the bodies called gravitational force.

5) If the moon attracts the earth, why does the earth not move towards the moon?

➤ The moon attracts the earth with the same gravitational force as the earth attracts the moon. Since the mass of earth is very large, the acceleration produced is negligible. Therefore, the earth does not move towards the moon.

6) What happens to the force between two objects, if

(i) the mass of one object is doubled? $2F$

(ii) the distance between the objects is doubled and tripled? $\frac{F}{4}$ and $\frac{F}{9}$

(iii) the masses of both objects are doubled? $4F$

7) What is the importance of universal law of gravitation?

- The gravitational force of attraction of the earth binds all terrestrial objects to the Earth.
- It explains the attractive force between any two objects which have mass.
- It explains the force that bind us to the Earth
- The motion of the moon around the Earth
- The motion of the planets around the sun.
- The tides due to the moon and the sun in the ocean on the earth.

8) What is the acceleration of free fall?

- 9.8 m/s^2

9) What do we call the gravitational force between the earth and an object?

- Weight

10) Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator. Will the friend agree with the weight of gold bought? If not, why? [Hint: The value of g is greater at the poles than at the equator.]

- Let m be the mass of the gold bought.

Also, let the acceleration due to gravity at poles and at equator be g_p and g_e respectively.

Acceleration due to gravity at poles is slightly greater than that at equator.

Weight of gold at the poles: $W_p = m g_p$

Weight of gold at equator: $W_e = m g_e$

But as $g_p > g_e \Rightarrow W_p > W_e$

Hence the weight of gold is slightly less at equator.

So, the friend will not agree with Amit about the weight of gold bought.

12) Gravitational force on the surface of the moon is only 1/6 as strong as gravitational force on the earth. What is the weight in newton of a 10 kg object on the moon and on the earth?

- Mass of the object = 10 kg

Weight of the object on earth = $W = m \times g$

$$\therefore W = 10 \times 9.8$$

$$W = 98 \text{ N}$$

Weight of the object on moon is $1/6^{\text{th}}$ weight on the earth.

$$\therefore \text{Weight of the object on moon} = 1/6 \times 98 = 16.3 \text{ N}$$

13) A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate

(a) the maximum height to which it rises,

(b) the total time it takes to return to the surface of the earth.

Initial velocity of the ball (u) = 49 m/s.

The velocity of the ball at maximum height (v) = 0 m/s

$$g = 9.8 \text{ m/s}^2$$

Let us consider the time taken is t to reach the maximum height H .

Consider a formula,

$$2gH = v^2 - u^2$$

$$2 \times (-9.8) \times H = 0 - (49)^2$$

$$-19.6 H = -2401$$

$$H = 122.5 \text{ m}$$

Now consider a formula,

$$v = u + g \times t$$

$$0 = 49 + (-9.8) \times t$$

$$-49 = -9.8t$$

$$t = 5 \text{ s}$$

(a) The maximum height to ball rises = 122.5 m

(b) The total time ball takes to return to the surface of the earth = $5 + 5 = 10 \text{ s}$

14) A stone is released from the top of a tower of height 19.6 m. Calculate its final velocity just before touching the ground.

➤ Initial Velocity $u = 0 \text{ m/s}$

Final velocity $v = ?$

Height, $s = 19.6 \text{ m}$

By third equation of motion

$$v^2 - u^2 = 2gs$$

$$v^2 = u^2 + 2gs$$

$$v^2 = 0 + 2 \times 9.8 \times 19.6$$

$$v^2 = 19.6 \times 19.6$$

$$v^2 = (19.6)^2$$

$$\Rightarrow v = 19.6 \text{ m/s}$$

15) A stone is thrown vertically upward with an initial velocity of 40 m/s. Taking $g = 10 \text{ m/s}^2$, find the maximum height obtained by the stone. What are the net displacement and the total distance covered by the stone?

➤ Initial Velocity $u = 40 \text{ m/s}$

Final velocity $v = 0 \text{ m/s}$

Height, $s = ?$

By third equation of motion

$$v^2 - u^2 = 2gs$$

$$0 - 40^2 = -2 \times 10 \times s$$

$$s = 1600/20$$

$$\Rightarrow s=80 \text{ m}$$

Total distance travelled by stone = upward distance + downward distance = $80 + 80 = 160 \text{ m}$

Total Displacement = 0, since, the initial and final point is same.

16) Calculate the force of gravitation between the earth and the Sun, given that the mass of the earth = $6 \times 10^{24} \text{ kg}$ and of the Sun = $2 \times 10^{30} \text{ kg}$. The average distance between the two is $1.5 \times 10^{11} \text{ m}$.

➤ Mass of earth = $6 \times 10^{24} \text{ kg}$

Mass of sun = $2 \times 10^{30} \text{ kg}$

Distance between earth and sun, $r = 1.5 \times 10^{11} \text{ m}$

$$F = \frac{GmM}{r^2}$$

$$F = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 2 \times 10^{30}}{(1.5 \times 10^{11})^2}$$

$$= 35.57 \times 10^{21} \text{ N}$$

$$= 3.557 \times 10^{22} \text{ N}$$

$$= 3.6 \times 10^{22} \text{ N}$$

17) A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 m/s. Calculate when and where the two stones will meet.

➤ Let t = time after which both stones meet

S = distance travelled by the stone dropped from the top of a tower

$(100-S)$ = distance travelled by the projected stone.

For stone dropped from the top of tower

$$-S = 0 + \frac{1}{2} (-10) t^2$$

$$\text{or, } S = 5t^2 \text{ ----(1)}$$

For stone projected upward

$$(100 - S) = 25t + \frac{1}{2} (-10) t^2 = 25t - 5t^2 \text{ -----(2)}$$

Adding (1) and (2), We get

$$100 = 25t$$

$$\text{or } t = 4 \text{ s}$$

Therefore, Two stones will meet after 4 s.

Put value of $t = 4 \text{ s}$ in Equation (1), we get

$$S = 5 \times 16 = 80 \text{ m.}$$

Thus, both the stone will meet at a distance of 80 m from the top of tower.

18) A ball thrown up vertically returns to the thrower after 6 s. Find

(i) the velocity with which it was thrown up,

- Time to reach Maximum height,

$$t = 6/2 = 3 \text{ s.}$$

$$v = 0 \text{ (at the maximum height)}$$

$$a = -9.8 \text{ m/s}^2$$

Using, $v = u + at$, we get

$$0 = u - 9.8 \times 3$$

$$0 = u - 29.4$$

$$u = 29.4 \text{ m/s}$$

(ii) the maximum height it reaches, and

- Thus, the velocity with which it was thrown up = 29.4 ms^{-1}

Using, $2aS = v^2 - u^2$, we get

$$S = \frac{v^2 - u^2}{2a}$$

$$= \frac{0 - (29.4)^2}{2 \times (-9.8)}$$

$$= \frac{-864.36}{-19.6}$$

$$= 44.1 \text{ m}$$

Thus, Maximum height it reaches = 44.1 m

(iii) its position after 4 s.

- Here, $t = 4 \text{ s}$. In 3 s , the ball reaches the maximum height and in 1 s it falls from the top.

Distance covered in 1 s from maximum height,

$$S = ut + \frac{1}{2} at^2$$

$$= 0 + \frac{1}{2} \times 9.8 \times 1$$

$$= 4.9 \text{ m}$$

Therefore, The ball will be 4.9 m below the top of the tower after 4 s .



Delhi Public School, Gandhinagar

Academic Session-2021-22

Class 9

Subject: Science

CHAPTER-3

ATOMS AND MOLECULES

		(Page No. 39)
Q.1		Write down the formulae of:
		(i) sodium oxide (ii) aluminium chloride (iii) sodium sulphide (iv) magnesium hydroxide
A.1		(i) Na_2O (ii) $AlCl_3$ (iii) Na_2S (iv) $Mg(OH)_2$
Q.2		Write down the names of compounds represented by following formulae:
		(i) $Al_2(SO_4)_3$ (ii) $CaCl_2$ (iii) K_2SO_4 (iv) KNO_3 (v) $CaCO_3$
A.2		(i) Aluminium sulphate (ii) Calcium chloride (iii) Potassium sulphate (iv) Potassium nitrate (v) Calcium carbonate
Q.3		What is meant by the term chemical formula?
A.3		A chemical formula is the representation of elements present in a compound with the help of symbols and the number of atoms of each element constituting the compound. e.g., a molecule of water (compound) contains 2 atoms of hydrogen and one atom of oxygen, hence its chemical formula is H_2O .
Q.4		How many atoms are present in a: (i) H_2S molecule and (ii) PO_4^{3-} ion?
A.4		(i) 2 atoms of hydrogen + 1 atom of sulphur = 3 atoms (ii) 1 atom of phosphorus + 4 atoms of oxygen = 5 atoms
		(Page No. 40)
Q.1		Calculate the molecular masses of $H_2, O_2, Cl_2, CO_2, CH_4, C_2H_6, C_2H_4, NH_3, CH_3OH$
A.1		Molecular mass of H_2 = atomic mass of H x 2 = 1×2 = 2u Molecular mass of O_2 = atomic mass of O x 2 = 16×2 = 32u Molecular mass of Cl_2 = atomic mass of Cl x 2

	$= 35.5 \times 2$ $= 71\text{u}$ Molecular mass of $\text{CO}_2 =$ atomic mass of C + (atomic mass of O x 2) $= 12 + (16 \times 2)$ $= (12 + 32)$ $= 44 \text{ u}$ Molecular mass of $\text{CH}_4 =$ atomic mass of Carbon + (atomic mass of Hydrogen x 4) $= 12 + (1 \times 4)$ $= 12 + 4$ $= 16 \text{ u}$ Molecular mass of $\text{C}_2\text{H}_6 =$ (atomic mass of Carbon x 2) + (atomic mass of Hydrogen x 6) $= 24 + 6$ $= 30\text{u}$ Molecular mass of $\text{C}_2\text{H}_4 =$ (atomic mass of Carbon x 2) + (atomic mass of Hydrogen x 4) $= 24 + 4$ $= 28\text{u}$ Molecular mass of $\text{NH}_3 =$ atomic mass of Nitrogen + (atomic mass of Hydrogen x 3) $= 14 + 3$ $= 17\text{u}$ Molecular mass of $\text{CH}_3\text{OH} =$ atomic mass of Carbon + (atomic mass of Hydrogen x 4) + atomic mass of Oxygen $= 12 + 4 + 16$ $= 32\text{u}$
Q.2	Calculate the formula unit masses of ZnO, Na₂O, K₂CO₃, given atomic masses of Zn = 65u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u.
A.2	Formula unit mass of: i) ZnO = Atomic mass of Zn + atomic mass of O $= 65 + 16$ $= 81 \text{ u}$ ii) Na₂O = (Atomic mass of Na x 2) + atomic mass of O $= (23 \times 2) + 16$ $= 46 + 16$ $= 62 \text{ u}$ iii) K₂CO₃ = Atomic mass of K + atomic mass of C + atomic mass of O $= (39 \times 2) + 12 + (3 \times 16)$ $= 78 + 12 + 48$ $= 138 \text{ u}$
	(Page No. 42)
Q.1	If one mole of carbon atoms weighs 12 grams, what is the mass (in grams) of 1 atom of carbon?
A.1	One mole of carbon atoms weighs 12g (Given) i.e., mass of 1 mole of carbon atoms = 12g \therefore mass of 6.022×10^{23} number of carbon atoms = 12g \therefore mass of 1 atom of carbon = $\frac{12}{6.022 \times 10^{23}}$ $= 1.99 \times 10^{-23}$
Q.2	Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given atomic mass of Na = 23 u, Fe = 56 u)?

A.2		<p>We can find out the element with more number of atoms by calculating number of moles of each of them: We can find out the element with more number of atoms by calculating number of moles of each of them: Number of moles of sodium in 100 g = $100/23 = 4.34$ Number of moles of iron in 100g = $100/56 = 1.78$ Therefore, the number of atoms is more for sodium as compared to iron.</p>																						
		(Exercise)																						
Q.3		What are polyatomic ions? Give examples.																						
A.3		A group of atoms containing positive or negative charge on them are called polyatomic ions. For NH_4^+ , NO_3^-																						
Q.4		Write the chemical formulae of the following.																						
		(a) Magnesium chloride (b) Calcium oxide (c) Copper nitrate (d) Aluminium chloride (e) Calcium carbonate																						
A.4		(a) MgCl_2 (b) CaO (c) $\text{Cu}(\text{NO}_3)_2$ (d) AlCl_3 (e) CaCO_3																						
Q.5		Give the names of the elements present in the following compounds.																						
		(a) Quick lime (b) Hydrogen bromide (c) Baking powder (d) Potassium sulphate.																						
A.5		<table border="1"> <thead> <tr> <th>S.No.</th> <th>Compounds</th> <th>Chemical formula</th> <th>Elements</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Quick lime</td> <td>CaO</td> <td>Calcium, Oxygen</td> </tr> <tr> <td>(b)</td> <td>Hydrogen bromide</td> <td>HBr</td> <td>Hydrogen, Bromine</td> </tr> <tr> <td>(c)</td> <td>Baking powder</td> <td>NaHCO_3</td> <td>Sodium, Hydrogen, Carbon, Oxygen</td> </tr> <tr> <td>(d)</td> <td>Potassium sulphate</td> <td>K_2SO_4</td> <td>Potassium, Sulphur, Oxygen</td> </tr> </tbody> </table>			S.No.	Compounds	Chemical formula	Elements	(a)	Quick lime	CaO	Calcium, Oxygen	(b)	Hydrogen bromide	HBr	Hydrogen, Bromine	(c)	Baking powder	NaHCO_3	Sodium, Hydrogen, Carbon, Oxygen	(d)	Potassium sulphate	K_2SO_4	Potassium, Sulphur, Oxygen
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Q.6		Calculate the molar mass of the following substances.																						
		(a) Ethyne, C_2H_2 (b) Sulphur molecule, S_8 (c) Phosphorus molecule, P_4(Atomic mass of phosphorus= 31) (d) Hydrochloric acid, HCl (e) Nitric acid, HNO_3																						
A.6		(a) Molar mass of ethyne, C_2H_2 $= (2 \times 12) + (2 \times 1)$ $= 26\text{g}$ (b) Molar mass of sulphur molecule, S_8 $= 8 \times 32$ $= 256\text{g}$ (c) Molar mass of phosphorus molecule, P_4 $= 4 \times 31$ $= 124\text{g}$ (d) Molar mass of hydrochloric acid, HCl																						

		$= 1 + 35.5$ $= 36.5\text{g}$ (e) Molar mass of nitric acid, HNO_3 $= (1 + 14) + (3 \times 16)$ $= 63\text{g}$
Q.7	(a) (b) (c)	What is the mass of— 1 mole of nitrogen atoms? 4 moles of aluminium atoms (Atomic mass of aluminium= 27)? 10 moles of sodium sulphite Na_2SO_3?
A.7	(a) (b) (c)	Atomic mass of nitrogen is 14 u. therefore 1 mol of N = 14g Atomic mass of aluminium = 27u Therefore, 1 mol of Al = 27g So, 4 mol of Al = 27×4 $= 108\text{g}$ Molecular mass of $\text{Na}_2\text{SO}_3 = (23 \times 2) + 32 + (16 \times 3)$ $= 46 + 32 + 48 = 126 \text{ u}$ Therefore 1 mol of Na_2SO_3 has weight/mass= 126g. hence, 10 mol of $\text{Na}_2\text{SO}_3 = 126 \times 10 = 1260\text{g}$
Q.8	(a) (b) (c)	Convert into mole. 12 g of oxygen gas 20 g of water 22 g of carbon dioxide
A.8	(a) (b) (c)	32 g of oxygen gas(O_2) = 1 mole Then, 12g of oxygen gas $= 12/32 \text{ mole}$ 0.375 mole 18g of water = 1 mole Then, 20 g of water $= 20/18 \text{ mole}$ $= 1.11 \text{ moles (approx.)}$ 44g of carbon dioxide = 1 mole Then, 22g of carbon dioxide $= 22/44 \text{ mole}$ $= 0.5 \text{ mole}$
Q.9	(a) (b)	What is the mass of: 0.2 mole of oxygen atoms? 0.5 mole of water molecules?
A.9	(a) (b)	Since 1 mole of O = atomic mass of O = 16u= 16g mol^{-1} Therefore, 0.2mole of O atoms = $0.2 \text{ mol} \times 16\text{g mol}^{-1}$ $= 3.2\text{g}$ Molar mass of $\text{H}_2\text{O} = (2 \times 1 + 16 \text{ g mol}^{-1}) = 18 \text{ g mol}^{-1}$ Mass of 1 mole of water molecules= 18 g mol^{-1} Mass of 0.5 mole of water molecules = $0.5 \text{ mol} \times 18 \text{ g mol}^{-1}$ $= 9.0\text{g}$
Q.10		Calculate the number of molecules of sulphur (S_8) present in 16 g of solid sulphur.
A.10		Molecular mass of $\text{S}_8 = 8 \times 32 = 256\text{u}$ 1mol of $\text{S}_8 = 256\text{g}$ Since 256g of $\text{S}_8 = 1 \text{ mole} = 6.022 \times 10^{23}$ molecules (Avogadro number) 16g of S_8 molecules = $\frac{16 \times 6.022 \times 10^{23}}{256} = 3.76 \times 10^{22}$ molecules

Q.11	<p>Calculate the number of aluminium ions present in 0.051 g of aluminium oxide. (Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u)</p>
A.11	<p>Molecular mass of $\text{Al}_2\text{O}_3 = (2 \times 27) + (3 \times 16) = 54 + 48 = 102\text{u}$ 1 mol of $\text{Al}_2\text{O}_3 = 102\text{g}$ aluminium ions present in $\text{Al}_2\text{O}_3 = 2 \text{ Al}^{3+}$ 102 g of Al_2O_3 contains aluminium ions = $2 \times 6.022 \times 10^{23}$ $\therefore 0.051 \text{ g Al}_2\text{O}_3$ contains aluminium ions = 6.022×10^{20} aluminium ions. (OR) 1 mole of aluminium oxide (Al_2O_3) = $2 \times 27 + 3 \times 16 = 102\text{g}$ i.e., 102g of $\text{Al}_2\text{O}_3 = 6.022 \times 10^{23}$ molecules of Al_2O_3 0.051g of $\text{Al}_2\text{O}_3 = 3.011 \times 10^{20}$ molecules of Al_2O_3 The number of aluminium ions present in one molecule of aluminium oxide is 2. \therefore The number of aluminium ions (Al^{3+}) present in 3.011×10^{20} molecules (0.051g) of aluminium oxide (Al_2O_3) = $2 \times 3.011 \times 10^{20} = 6.022 \times 10^{20}$</p>



Delhi Public School, Gandhinagar

Academic Session-2021-22

Class 9

Subject: Science

CHAPTER-2: IS MATTER AROUND US PURE

No. of Periods: 15

Pg. No. 15

- Q.1 **What is meant by a pure substance?**
A.1 Substance that has a uniform composition i.e. has particles with identical properties is called pure substance.
- Q.2 **List the points of differences between homogeneous and heterogeneous mixtures.**
A.2 Same as Q.1 Pg. No 18 of text book.

Page No. 18

- Q.1 **Differentiate between homogeneous and heterogeneous mixtures with examples.**

	Homogeneous Mixture	Heterogeneous Mixture
1.	It is a uniform mixture.	It is a non- uniform mixture.
2.	Distinct boundaries are not visible.	Distinct boundaries are visible in some solid mixtures and immiscible liquid mixture.

- Q.2 **How are sol, solution and suspension different from each other?**

	Properties	Solution	Colloid	Suspension
1.	Particle size	Less than 1nm	Between 1nm-100nm	Larger than 100nm
2.	Nature	Homogeneous	Heterogeneous	Heterogeneous
3.	Filterability	It passes through filter paper	It passes through filter paper	It does not pass through filter paper
4.	Tyndall effect	Does not show as scattering of light do not occur	Shows the effect as scattering of light occurs	May or may not show tyndall effect

- Q.3 **To make a saturated solution, 36 g of sodium chloride is dissolved in 100 g of water at 293K. Find its concentration at this temperature.**

- A.3
Mass of solute (sodium chloride) =36g
Mass of solvent (water) =100g
Mass of solution = Mass of Solute + Mass of solvent
= 36g +100g
= 136g
Concentration= Mass of solute/Mass of solution x 100
= 36/136 x 100
=26.5%

Page No. 24 A

- Q.1 **How will you separate a mixture containing kerosene and petrol (difference in their boiling points is more than 25°C), which are miscible with each other?**
A.1 We can separate a mixture containing kerosene and petrol by distillation technique since difference in their boiling points is more than 25°C. Therefore, they can be easily separated by the technique of simple distillation.

- Q.2 **Name the technique to separate**
 (i) butter from curd, (ii) salt from sea-water, (iii) camphor from salt
- A.2 (i) centrifugation method
 (ii) evaporation method or crystallisation method
 (iii) sublimation method
- Q.3 **What types of mixtures are separated by the technique of crystallisation?**
- A.3 From impure samples of solids, pure solid crystals can be obtained by the method of crystallization for e.g. to obtain pure sugar from impure sample of the same.

Page No. 24 B

- Q.1 **Classify the following as chemical or physical changes:**
- cutting of trees,
 - melting of butter in a pan,
 - rusting of almirah,
 - boiling of water to form steam,
 - passing of electric current through water and the water breaking down into hydrogen and oxygen gases,
 - dissolving common salt in water,
 - making a fruit salad with raw fruits, and
 - burning of paper and wood.
- A.1
- Cutting of trees = physical change
 - Melting of butter in a pan = physical change
 - Rusting of almirah = chemical change
 - Boiling of water to form steam = physical change
 - Passing of electric current through water and the water breaking down into hydrogen and oxygen gases = chemical change
 - Dissolving common salt in water = physical change
 - Making a fruit salad with raw fruits = physical change
 - Burning of paper and wood = chemical change
- Q.2 **Try segregating the things around you as pure substances or mixtures.**
- A.2 To be discussed in the class

Pg No. 28 Exercises

- Q.1 **Which separation techniques will you apply for the separation of the following?**
- (a) Sodium chloride from its solution in water.
 - (b) Ammonium chloride from a mixture containing sodium chloride and ammonium chloride.
 - (c) Small pieces of metal in the engine oil of a car.
 - (d) Different pigments from an extract of flower petals.
 - (e) Butter from curd.
 - (f) Oil from water.
 - (g) Tea leaves from tea.
 - (h) Iron pins from sand.
 - (i) Wheat grains from husk.
 - (j) Fine mud particles suspended
- A.1
- (a) Evaporation
 - (b) Sublimation
 - (c) Filtration
 - (d) Chromatography
 - (e) Centrifugation
 - (f) Separating funnel
 - (g) Filtration

- (h) With the help of a magnet
- (i) Blowing air or sieving
- (j) Using alum

Q.2 **Write the steps you would use for making tea. Use the words solution, solvent, solute, dissolve, soluble, insoluble, filtrate and residue.**

A.2 To be discussed in class.

Q.3 **Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution.**

<i>Substance Dissolved</i>	<i>Temperature in K and Solubility</i>				
	283	293	313	333	353
<i>Potassium nitrate</i>	21	32	62	106	167
<i>Sodium chloride</i>	36	36	36	37	37
<i>Potassium chloride</i>	35	35	40	46	54
<i>Ammonium chloride</i>	24	37	41	55	66

A.3 (a) **What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?**

A. Mass of potassium nitrate to produce a saturated solution in 100g of water at 313 K=62g
Therefore, mass of potassium nitrate in 50 g of water at 313= $62 \times 50/100 = 31\text{g}$

(b) **Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.**

A. When a saturated solution of potassium chloride at 353 K is cooled, the solubility of potassium chloride in water decreases. As a result, the amount of potassium chloride which exceeds its solubility at lower temperature separates out as crystals.

(c) **Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?**

A. Solubility of each salt at 293 K:

Potassium nitrate= 32g

Sodium chloride= 36g

Potassium chloride= 35g

Ammonium chloride=37g

The highest solubility is of ammonium chloride at this temperature.

(d) **What is the effect of change of temperature on the solubility of a salt?**

A. Solubility of salts is directly proportional to the temperature i.e. if temperature increases then solubility will increase and if the temperature decreases solubility will also decrease.

Q.4 **Explain the following giving examples.**

(a) **saturated solution**

(b) **pure substance**

(c) **colloid**

(d) **suspension**

A.4 (a) **Saturated solution:** - It is a solution in which no more solute particles can be dissolved at a particular temperature. For example, adding chocolate powder to milk so that it stops dissolving forms a saturated solution.

(b) **Pure substance:** - Such substance that has a uniform composition i.e. has particles with identical properties is called pure substance e.g. sugar, salt, water, nitrogen etc.

(c) **Colloid:** - It is a kind of heterogeneous mixture/solution in which particle size is between 1nm and 100nm. Colloids have dispersion medium and dispersed phase.eg smoke, fog.

- (d) **Suspension:** - It is a kind of heterogeneous mixture in which insoluble solid particles remain suspended in the medium and dispersion particles are visible to the unaided eyes.
e.g., muddy river water

Q.5, Q.7 to Q.11 to be discussed in the class and marked in the text book.

Q.5 **Classify each of the following as a homogeneous or heterogeneous mixture.
Soda water, wood, air, soil, vinegar, filtered tea.**

A.5 Homogeneous: Soda water, vinegar, filtered tea, air
Heterogeneous: Wood, soil.

Q.6 **How would you confirm that a colourless liquid given to you is pure water?**

A.6 If the boiling point and freezing point of the given liquid comes out to be 100 degrees celsius (373 K) or 0° celsius (273 K) respectively under one atmosphere pressure, it confirms that the given liquid is pure water.

Q.7 **Which of the following materials fall in the category of a “pure substance”?**

- (a) **Ice**
- (b) **Milk**
- (c) **Iron**
- (d) **Hydrochloric acid**
- (e) **Calcium oxide**
- (f) **Mercury**
- (g) **Brick**
- (h) **Wood**
- (i) **Air**

A.7 Pure substances are: ice, iron, hydrochloric acid, calcium oxide, mercury since they contain particles of only one kind of matter.

Q.8 **Identify the solutions among the following mixtures.**

- A.8
- (a) **Soil**
 - (b) **Sea water**
 - (c) **Air**
 - (d) **Coal**
 - (e) **Soda water.**

Sea water and soda water are solutions.

Q.9 **Which of the following will show “Tyndall effect”?**

- (a) **Salt solution**
- (b) **Milk**
- (c) **Copper sulphate solution**
- (d) **Starch solution.**

A.9 (b) and (d) (to be discussed in class.)

Q.10 **Classify the following into elements, compounds and mixtures:**

- (a) **Sodium**
- (b) **Soil**
- (c) **Sugar solution**
- (d) **Silver**
- (e) **Calcium carbonate**
- (f) **Tin**
- (g) **Silicon**
- (h) **Coal**
- (i) **Air**

A.10 Classification of the given substances in elements, compounds and mixtures:
Elements: Sodium, Silver, Tin and Silicon.
Compounds: Calcium carbonate, Methane and carbon dioxide.
Mixtures: Soil, Sugar, Coal, Air, Soap and Blood.

Q.11 **Which of the following are chemical changes?**

- (a) **Growth of a plant**
- (b) **Rusting of iron**
- (c) **Mixing of iron filings and sand**
- (d) **Cooking of food**
- (e) **Digestion of food**
- (f) **Freezing of water**
- (g) **Burning of a candle**

A.11 Growth of a plant, rusting of iron, cooking of food, digestion of food, burning of a candle are chemical changes.

Chapter2: Is Matter Around Us Pure

Extra Questions 2021-22

- Q.1 A fractionating column in the set-up of fractional distillation is provided with beads. Give reason.
- Q.2 List two conditions essential for using distillation as a method for separation of the components from a mixture.
- Q.3 Is water a compound? Justify your answer.
- Q.4 Calculate the concentration of 45 g salt present in 500 g of solution.
- Q.5 a) On heating, calcium carbonate gets converted into calcium oxide and carbon dioxide. Identify the process as a physical or chemical.
- b) Name a non-metal which:
- i) is required for combustion ii) exist as a liquid at room temperature.

CHAPTER-6

TISSUES

Intext Questions: Page No.69

Q.1 What is a tissue?

Ans It is a group of cells similar in origin and structure and they are specialized to perform a particular function like muscle cells in our body forms the muscle tissue that brings about body movements (specific function).

Q.2 What is the utility of tissues in multi-cellular organisms?

Ans There is division of labour in multicellular organisms i.e. different parts of the body of a multicellular organism perform specific functions. For example, brain controls all other parts of body, heart pumps blood to all parts of body, kidneys remove waste materials from body, sense organs collect information from external sources for sensory perception etc. All these functions would never be possible without formation of tissues in multicellular organisms.

Pg. No. 74

Q.1 Name types of simple tissues.

Ans. The simple tissues (found in plants) are of following three types:

- (a) Parenchyma
- (b) Collenchyma
- (c) Sclerenchyma

Q.2 Where is apical meristem found?

Ans The apical meristem is found at the apex (growing tips) of the stem and roots.

Q.3 Which tissue makes up the husk of coconut?

Ans Sclerenchymatous fibres

Q.4 What are the constituents of phloem?

Ans The constituents of phloem are: sieve tubes, companion cells, phloem parenchyma, phloem fibres (bast).

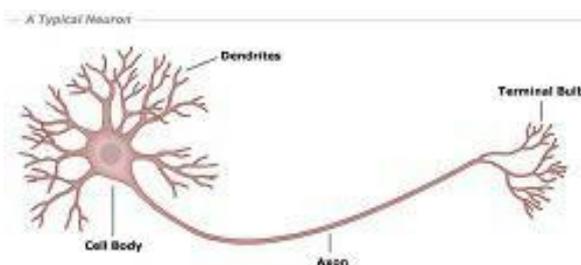
Pg. No. 78

Q.1 Name the tissue responsible for movement in our body.

Ans Muscle/muscular tissue.

Q.2 What does a neuron look like?

Ans A neuron comprises of a cell body (Cyton) along with one or more short branches (Dendron) and one hair like long branch (Axon).



Q.3 Give three features of cardiac muscles.

Ans (i) Cardiac muscles are involuntary i.e. they don't work under our will.
(ii) Its cells are cylindrical, branched, faintly striated and uninucleate.

(iii) It shows rhythmic contraction and relaxation throughout the person's life.

Q.4 What are the functions of areolar tissue?

Ans Areolar tissue is a kind of filler tissue found between skin and muscles, around our blood vessels and nerve cells and also in the bone marrow. Its functions are therefore

- i) To fill the space inside organs.
- ii) To help in repair and maintenance of nearby tissues/organs.
- iii) To support and prevent injuries to internal organs.

Exercise Questions: Page no 79

Q.1 Define the term "tissue" (Already discussed)

Q.2 How many types of elements together make up the xylem tissue? Name them. (To be marked in textbook)

Xylem tissue is made up of following 4 types of elements:

- i) Tracheids; ii) Vessels; iii) Xylem fibres and iv) Xylem parenchyma

Q.3 How are simple tissues different from complex tissues in plants?

Ans

Simple tissue	Complex tissue
i) It is made up of only one type of cells. ii) All cells of this tissue work as individual units to perform a particular function. Eg. parenchyma, collenchyma and sclerenchyma tissues.	i) It is made up of more than one type of cells. ii) Cells of this tissue work together as one single unit to bring about a particular function. Eg. xylem and phloem tissues.

Q.4 Differentiate between parenchyma, collenchyma and sclerenchyma on the basis of their cell wall.

Ans

Parenchyma	Collenchyma	Sclerenchyma
Cell wall is thin and made up of cellulose.	Cell wall is irregularly thickened at corners due to deposition of pectin.	Cell wall is very thick due to deposition of impermeable substance lignin.

Q.5 What are the functions of the stomata?

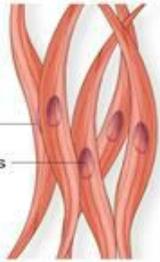
Ans The functions of stomata are:

- i) Gaseous exchange like exchange of CO₂ and O₂.
- ii) Process of transpiration i.e. loss of excess water in the form of water vapour occurs through stomata.

Q.6 Diagrammatically show the difference between the three types of muscle fibres.

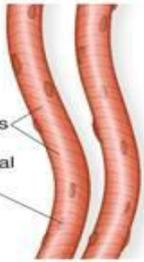
Ans

Visceral
(smooth)



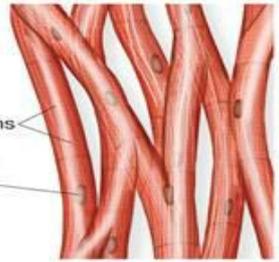
No striations
Central nucleus

Skeletal
(striated)



Striations
Peripheral nuclei

Cardiac



Striations
Central nuclei

Contracts	Slowly	Rapidly	Rapidly
Found	Viscera, blood vessels	Trunk, extremities, head and neck	Heart
Control	Involuntary	Voluntary	Involuntary

Q.7 What is the specific function of the cardiac muscle?

Ans Cardiac muscles are the muscles of heart that pumps blood to all parts of body and the pumping needs rhythmic contraction and relaxation of cardiac muscles throughout the life without any fatigue.

Q.8 Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body. (To be combined with Q.6)

Ans

Striated muscle	Unstriated muscle	Cardiac muscle
They show light and dark bands (striations) when we stain them. Their cells are elongated and cylindrical also unbranched. Cells are multinucleate.	They don't show any striations on staining. Their cells are long but spindle shaped and unbranched. Cells are uninucleate.	They show striations on staining. Their cells are cylindrical and branched. Cells are uninucleate.
They are responsible to bring about voluntary movements (like tongue, limbs etc)	They are involuntary in action (walls of tubular organs, blood vessels etc)	They are again involuntary in their function (contraction and relaxation of heart)

Q.9 Draw a labelled diagram of a neuron. (Already discussed)

Q.10 Name the following. (To be marked in textbook)

Ans (a) Tissue that forms the inner lining of our mouth- Epithelial tissue

(b) Tissue that connects muscle to bone in humans- Tendon

(c) Tissue that transports food in plants- Phloem

(d) Tissue that stores fat in our body- Adipose

(e) Connective tissue with a fluid matrix- Blood and lymph

(f) Tissue present in the brain- Nervous tissue

Q.11 Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle. (To be marked in textbook)

Ans

Skin	Epithelial tissue
Bark of tree	Sclerenchymatous tissue
Bone	Connective tissue
Lining of kidney tubule	Cuboidal epithelial tissue
Vascular bundle	Complex permanent tissue

Q.12 Name the regions in which parenchyma tissue is present.

Ans Parenchymatous tissue is present in the epidermis, cortex, pith of the stem, root, leaves, flowers and fruits of plants.

Q.13 What is the role of epidermis in plants?

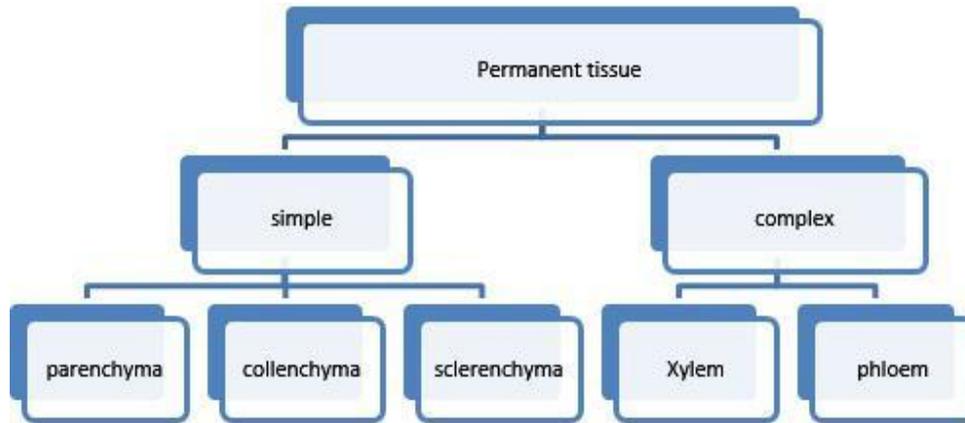
Ans It is a protective layer to the plant parts. It can also absorb water from soil like in the roots and even allow exchange of gases through stomata. It also helps in preventing the entry of pathogens.

Q.14 How does the cork act as a protective tissue?

Ans In plants the secondary meristem cuts off many external layers of cells that are dead and arranged in a compact manner. Such layers together make cork. They have deposition of suberin which is very hard and impermeable hence protects plants from unfavourable conditions and microbial attack etc.

Q.15 Complete the table: (To be marked in textbook)

Ans



Additional Study Material

1. **Plant tissues:**
Plant tissues are of various types and they are made up of similar types of cells. They are different from animal tissues since there are several differences between the animal and plant cell.
2. **Animal tissues:**
Animal tissues are made up of animal cells. These tissues are usually not rigid since the cells do not have cell walls.
3. **Meristematic tissues:**
Meristematic tissues are seen in plants. They are primarily made up of rapidly dividing cells. They are the growing tissues of the plant.
4. **Permanent tissues:**
Permanent tissues arise from the meristematic tissue and have structural and functional properties. Permanent tissue can be made up of either living or dead cells.
5. **Differentiation:**
Differentiation is the process by which the meristematic tissues develop into different types of permanent tissues based on the location and requirement of the plant.
- 6.(a) **Apical meristem:**
Apical meristem are present on the apex of the plant shoot and root. They are rapidly growing tissues and aid in increasing the height of the plant.
- (b) **Lateral meristem:**
Lateral meristem are present on the lateral walls of the stem. They help in the horizontal growth of the plant and increasing the stem girth.
- (c) **Intercalary meristem:**
Intercalary meristem can be found between the nodes of the stem and the base of the leaf. They help in branching.
7. **Simple permanent tissues:**
These are tissues that are made up of only one type of cells. They usually have structural role.
 - (a) **Parenchyma:**
Parenchyma tissues are made up of loosely packed cells with thin cell walls and large intercellular spaces. They are live cells and help in support and storage. Two types; Chlorenchyma and Arenchyma.
 - (b) **Collenchyma:**
Collenchyma tissues are made up of live cells which have irregularly thickened corners and thus, have decreased intercellular spaces. They help in bending of

various parts of the plant without breaking.

(c) **Sclerenchyma:**

Sclerenchyma tissues make up the hard and stiff parts of the plant. They are made up of dead, long and narrow cells. They almost have no intercellular space as the walls are thickened due to the presence of lignin.

8. **Complex permanent tissues:**

Complex permanent tissues are made by combination of different types of cells. These cells work together to perform a specific task.

(a) **Phloem:**

Phloem is made up of the following components – sieve tubes, companion cells, phloem parenchyma and phloem fibres. Phloem conducts food in both directions. Among all the components, phloem fibres are the only dead cells.

(b) **Xylem:**

Xylem is made up of the following components- Tracheids, Vessels, Xylem parenchyma and Xylem fibres. The vessels and tracheids – help in conduction of water and minerals from the soil. Xylem parenchyma helps in food storage and the Xylem fibres provide mechanical support.

9. **Animal Tissues-**

Epithelial Tissues:

Epithelial tissues are seen on the outer layer of a body or organ surface. They form the outermost protective layer of most of the animals.

(a) **Squamous Epithelium:**

Squamous epithelium form an extremely thin and flat layer of tissues. They are semi-permeable and thus, perfect for gaseous exchange. They are present in the lining of oesophagus and mouth.

(b) **Cuboidal Epithelium:**

As the name suggests, they are cuboidal in shape and form the lining of salivary glands and kidney tubules. They provide mechanical support. They also form glandular epithelium when they form glands.

(c) **Columnar Epithelium:**

These tissues line the organs which help in absorption and secretion, such as lining of intestines. They are made up of elongated cells. When cilia is present on these cells, they form ciliated columnar epithelium like those present in the respiratory tract.

(d) **Stratified Squamous Epithelium:**

This kind of tissue is formed when multiple layers of squamous epithelium are arranged in a pattern. Our skin is made up of this kind of tissue.

10. **Connective Tissues:**

These tissues help in connecting different parts of the body. Examples include, blood, bones, cartilages, tendons, ligaments, areolar tissues and adipose tissues.

11. **Muscular Tissue:**

These tissues make up our muscles which are responsible for almost all the movements that take place in the body.

(a) **Striated/Skeletal Muscles:**

All the voluntary movements in our body is carried out by the striated or skeletal muscles. They are called skeletal because these tissues are mostly attached to the bones. They are long, cylindrical, unbranched with striations and are multinucleated.

(b) **Unstriated/Smooth Muscles:**

Almost all the involuntary movements in the body are carried out by the smooth or

striated muscles. They are long, smooth, spindle shaped and uninucleate. We can find them in places like alimentary canal and blood vessels.

(c) **Cardiac Muscles:**

Cardiac muscles make up our entire heart. These muscles are involuntary in nature and show rhythmic contractions and relaxations. Structurally they may look quite similar to striated muscles but they are branched, uninucleate and have intercalated discs.

12. Nervous Tissue:

Nervous tissue makes up the entire brain, spinal cord and nerves of the body. They are responsible for all sensations, consciousness, memory and emotion.

Neurons:

These are the cells that form the entire nervous system. The cell consists of a cell body, axon and dendrites

CLASS 9 PHYSICS STUDY MATERIAL
CHAPTER- 9 FORCE AND LAWS OF MOTION

INTEXT QUESTIONS (Page No.118)

1. Which of the following has more inertia:
- (a) a rubber ball and a stone of the same size?
 - (b) a bicycle and a train?
 - (c) a five-rupees coin and a one-rupee coin?
- (a) A stone of the same size
- (b) a train
- (c) a five-rupees coin

As the mass of an object is a measure of its inertia, objects with more mass have more inertia.

2. In the following example, try to identify the number of times the velocity of the ball changes “A football player kicks a football to another player of his team who kicks the football towards the goal The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team”. Also identify the agent supplying the force in each case.

Agent supplying the force	Change in velocity of ball
1. First player kicks a football.	→ Velocity from '0' changes to 'u'
2. Second player kicks the football towards the goal.	→ Velocity changes again
3. The goalkeeper collects the football.	→ Velocity becomes 0
4. Goalkeeper kicks it towards a player of his team.	→ Change in velocity takes place

The velocity of football changes four times.

3. Explain why some of the leaves may get detached from a tree if we vigorously shake its branch.
- When the tree's branch is shaken vigorously the branch attains motion but the leaves stay at rest. Due to the inertia of rest, the leaves tend to remain in its position and hence detaches from the tree to fall down.
4. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest?
- When a moving bus brakes-to a stop: When the bus is moving, our body is also in motion, but due to sudden brakes, the lower part of our body comes to rest as soon as the bus stops. But the upper part of our body continues to be in motion and hence we fall in forward direction due to inertia of motion. When the bus accelerates from rest we fall backwards: When the bus' is stationary our body is at rest but when the bus accelerates, the lower part of our body being in contact with the floor of the bus comes in motion, but the upper part of our body remains at rest due to inertia of rest. Hence we fall in backward direction.

INTEXT QUESTIONS (Page No.126-127)

1. If action is always equal to the reaction, explain how a horse can pull a cart?

The third law of motion states that action is always equal to the reaction but they act on two different bodies. In this case the horse exerts a force on the ground with its feet while walking, the ground exerts an equal and opposite force on the feet of the horse, which enables the horse to move forward and the cart is pulled by the horse.

2. Explain why is it difficult for a fireman to hold a hose, which ejects a large amount of water at a high velocity.

The water that is ejected out from the hose in the forward direction comes out with a large momentum and equal amount of momentum is developed in the hose in the opposite direction and hence the hose is pushed backward. It becomes difficult for a fireman to hold a hose which experiences this large momentum.

3. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35 m/s. Calculate the initial recoil velocity of the rifle.

(m_1) Mass of rifle = 4 kg

(m_2) Mass of bullet = 50 g = 0.05 kg

(v_2) Velocity of bullet = 35 m/s

(v_1) Recoil velocity of rifle = ?

According to the law of conservation of momentum

Momentum of rifle = momentum of bullet

$$m_1 v_1 = m_2 v_2$$

$$4 \text{ kg} \times v_1 = 0.05 \times 35 \text{ m/s}$$

$$\therefore v_1 = \frac{0.05 \times 35}{4} = \frac{1.75}{4}$$

$$v_1 = 0.4375 \text{ m/s}$$

\therefore Recoil velocity of rifle = 0.4375 m/s

4. Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2 m/s and 1 m/s respectively. They collide and after the collision the first object moves at a velocity of 1.67 m/s. Determine the velocity of the second object.

$$m_1 = 100 \text{ g} = 0.1 \text{ kg}$$

$$m_2 = 200 \text{ g} = 0.2 \text{ kg}$$

$$u_1 = 2 \text{ m/s}$$

$$u_2 = 1 \text{ m/s}$$

After collision

$$v_1 = 1.67 \text{ m/s}$$

$$v_2 = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$(0.1 \times 2) + (0.2 \times 1) = (0.1 \times 1.67) + (0.2 \times v_2)$$

$$\therefore 0.2 + 0.2 = 0.167 + 0.2v_2$$

$$0.4 - 0.167 = 0.2v_2$$

$$\frac{0.4 - 0.167}{0.2} = v_2$$

$$\therefore \frac{0.233}{0.2} = 1.165 \text{ m/s}$$

\therefore The velocity of the second object is 1.165 m/s.

CLASS-IX SCIENCE(PHYSICS) CHAPTER-8 MOTION

INTEXT QUESTIONS (Page No.103)

- 1 When will you say a body is in
(i) uniform acceleration
(ii) non-uniform acceleration
- A (i) Uniform acceleration: When a body changes its velocity equally in equal time interval, then the body is said to be in uniform acceleration.
(ii) Non-uniform acceleration: When a body changes its velocity unequally in equal time interval, then the body is said to be in non-uniform acceleration.
- 2 A bus decreases its speed from 80 km/h to 60 km/h in 5 s. Find the acceleration of the bus.
- A Initial velocity = 80 km/h = 22.22 m/s
Final velocity = 60 km/h = 16.67 m/s
Time taken, $t = 5$ s
Acceleration, $a = (v-u)/t = (16.67 - 22.22)/5 = -1.11 \text{ m/s}^2$
The acceleration of bus is -1.11 m/s^2 .
- 3 A train starting from a railway station and moving with uniform acceleration attains a speed 40 km/h in 10 minutes. Find its acceleration.
- A Final speed, $v = 40 \text{ km/h} = 11.1 \text{ m/s}$, Initial velocity = 0 m/s
Time taken, $t = 10 \times 60 \text{ s} = 600\text{s}$
Acceleration, $a = (v-u)/t = (11.1 - 0)/600 = 1.85 \times 10^{-2} \text{ m/s}^2$
The acceleration of a train is $1.85 \times 10^{-2} \text{ m/s}^2$

INTEXT QUESTIONS (Page No.107)

- 1 What is the nature of the distance-time graphs for uniform and non-uniform motion of an object?
- A When the motion is uniform, the distance-time graph is a linearly inclined. When the motion is non-uniform, the distance time graph is curve/zigzag.
- 2 What can you say about the motion of an object whose distance-time graph is a straight line parallel to the time axis?
- A When distance-time graph of an object is a straight line parallel to the time axis, distance of the object at every instant of time is the same. Therefore, the object must be at rest.
- 3 What can you say about the motion of an object if its speed-time graph is a straight line parallel to the time axis?
- A When speed-time graph of a body is a straight line parallel to the time axis, speed of the body at every instant of time is the same. It means the body is in uniform motion.
- 4 What is the quantity which is measured by the area occupied below the velocity-time graph?
- A The area occupied below the velocity-time graph is a measure of the distance/displacement travelled by the body.

INTEXT QUESTIONS (Page No.109)

- 1 A bus starting from rest moves with a uniform acceleration of 0.1 m/s^2 for 2 minutes. Find
(a) the speed acquired,
(b) the distance travelled.

Here, $u = 0$, $a = 0.1 \text{ m/s}^2$,
 $t = 2 \text{ min} = 2 \times 60 \text{ s} = 120 \text{ s}$

(a) From $v = u + at$, $v = 0 + 0.1 \times 120 = 12 \text{ m/s}^{-1}$

(b) From $s = ut + \frac{1}{2}at^2$,

$s = 0 \times 120 + \frac{1}{2} \times 0.1(120)^2 = 7.2 \times 10^2 \text{ m}$

- 2 A train is travelling at a speed of 90 km/h. Brakes are applied so as to produce a uniform

acceleration of -0.5 m/s^2 . Find how far the train will go before it is brought to rest.

$$u = 90 \text{ km h}^{-1} = \frac{90 \times 1000}{60 \times 60} = 25 \text{ m s}^{-1}$$

Acceleration, $a = -0.5 \text{ m s}^{-2}$, final velocity, $v = 0$

From

$$v^2 - u^2 = 2as,$$

Distance travelled

$$s = \frac{v^2 - u^2}{2a} = \frac{0 - (25)^2}{2 \times (-0.5)} = 625 \text{ m}$$

- 3 A trolley, while going down an inclined plane, has an acceleration of 2 cm/s^2 starting from rest, what will be its velocity 3 s after the start?

Here, acceleration, $a = 2 \text{ m s}^{-2}$,

Time taken, $t = 3 \text{ s}$

Initial velocity, $u = 0$

Final velocity, $v = u + at = 0 + 2 \times 3 = 6 \text{ cm s}^{-1}$

- 4 A racing car has a uniform acceleration of 4 m/s^2 . What distance will it cover in 10 s after start?

$$\therefore s = ut + \frac{1}{2}at^2$$

$$= 0 \times 10 + \frac{1}{2} \times 4 \times (10)^2 = 0 + \frac{1}{2} \times 4 \times 100$$

$$\therefore s = 200 \text{ m}$$

- 5 A stone is thrown in vertically upward direction with a velocity of 5 m/s . If the acceleration of the stone during its motion is 10 m/s^2 in the downward direction, what will be the height attained by the stone and how much time will it take to reach there?

$u = 5 \text{ m s}^{-1}$, $v = 0$, $a = -10 \text{ m s}^{-2}$

(i) $v = u + at$

$$0 = 5 + (-10)t$$

$$-5 = -10t \quad \therefore t = \frac{5}{10} = 0.5 \text{ s}$$

(ii) $v^2 - u^2 = 2as$

$$(0)^2 - (5)^2 = 2(-10) \times s$$

$$-25 = -20 \times s \quad \therefore s = \frac{25}{20} = 1.25 \text{ m}$$

EXERCISE QUESTIONS

- 4 A motorboat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 m/s^2 for 8.0 s . How far does the boat travel during this time?

A $u = 0$, $a = 3.0 \text{ m s}^{-2}$, $t = 8 \text{ s}$

$$s = ut + \frac{1}{2}at^2 = 0 \times t + \frac{1}{2}(3) \times (8)^2$$

$$s = \frac{1}{2} \times 3 \times 64 = 96 \text{ m}$$

\therefore Boat travelled a distance of 96 m .

5. A driver of a car travelling at 52 km h^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5 s . Another driver going at 3 km h^{-1} in another car applies his brakes slowly and stops in 10 s . On the same graph paper, plot the speed versus time graphs for the two cars. Which of the two cars travelled farther after the brakes were applied?

A For first car:

Initial velocity $u = 52 \text{ km h}^{-1}$

$$= \frac{52 \text{ km}}{1 \text{ h}} = \frac{52 \times 1000 \text{ m}}{1 \times 3600 \text{ s}} = 14.4 \text{ m s}^{-1}$$

Final velocity, $v = 0 \text{ km h}^{-1} = 0.0 \text{ m s}^{-1}$

Time taken, $t = 5 \text{ s}$

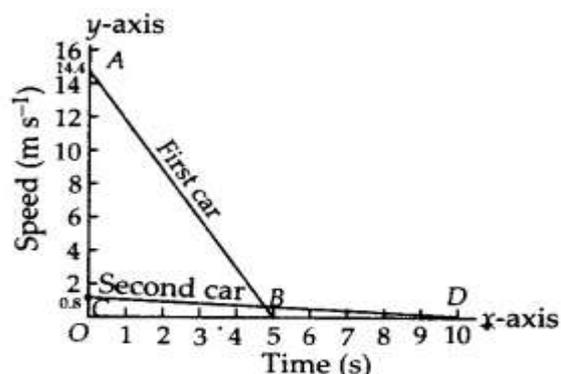
For second car :

Initial velocity, $u = 3 \text{ km h}^{-1}$

$$= \frac{3 \text{ km}}{1 \text{ h}} = \frac{3 \times 1000 \text{ m}}{1 \times 3600 \text{ s}} = 0.8 \text{ m s}^{-1}$$

Final velocity, $v = 0 \text{ km h}^{-1} = 0.0 \text{ m s}^{-1}$

Time taken, $t = 10 \text{ s}$



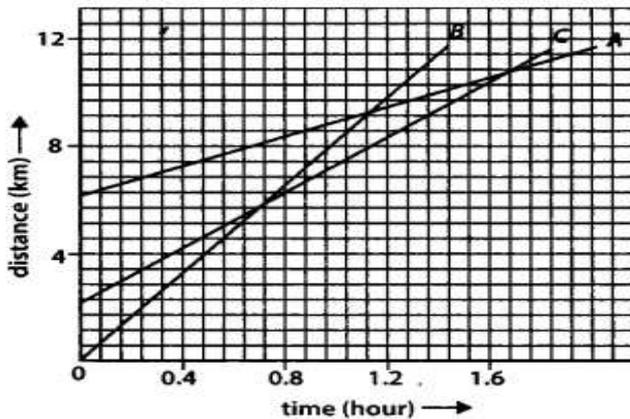
The distance travelled by 1st Car = $\frac{1}{2} \times OB \times AO = \frac{1}{2} \times 14.4 \times 5 = 36 \text{ m}$

The distance travelled by 2nd Car: = $\frac{1}{2} \times OD \times CO = \frac{1}{2} \times 0.83 \times 10 = 4.1 \text{ m}$

Therefore, 1st car travelled farther than 2nd car.

6 Figure given below shows the distance-time graph of three objects A, B and C. Study the graph and answer the following questions?

- (a) Which of the three is travelling the fastest?
- (b) Are all three ever at the same point on the road?
- (c) How far has C travelled when B passes A?
- (d) How far has B travelled by the time it passes C?



- (a) B is travelling fastest.
- (b) As three lines do not meet at any point, the three objects never meet on the road.
- (c) B passes A at D. At this time, C is at E, which corresponds to 7 km. Hence when B crosses A, then C is at 7 km from the origin.
- (d) By the time B passes C, it has travelled 4.5 km

7 A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10 m/s², with what velocity will it strike the ground? After what time will it strike the ground?

A Here $s = 20 \text{ m}$, $u = 0$, $a = 10 \text{ m s}^{-2}$

We have, $s = ut + \frac{1}{2}at^2$

$$\therefore (20) = 0 \times t + \frac{1}{2}(10)t^2 \Rightarrow 20 = \frac{1}{2} \times 10t^2$$

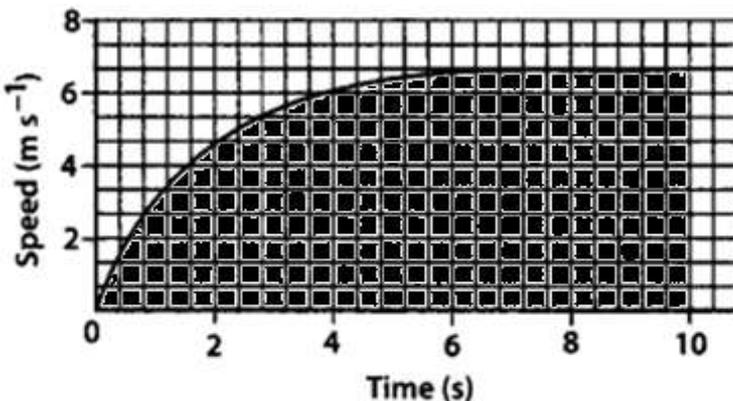
$$\frac{20 \times 2}{10} = t^2 \Rightarrow t^2 = 4$$

$$\therefore t = 2 \text{ s}$$

$$v = u + at = 0 + 10 \times 2 = 20 \text{ m s}^{-1}$$

8 The speed-time graph for a car is shown in the figure.

- (a) Find how far does the car travel in the first 4 seconds? Shade the area on the graph that represents the distance travelled by the car during the period.
- (b) Which part of the graph represents uniform motion of the car?



- A (a) Number of squares in shaded part of the graph = 320.5
- (b) One small square in x axis represent $t = 2/5 \text{ s}$

One small square on y axis represent $v = \frac{2}{3} \text{ m s}^{-1}$

$$\therefore \text{ area of each square, } v \times t = \frac{2}{3} \times \frac{2}{5} = \frac{4}{15} \text{ m}$$

$$\text{Total area} = 61.5 \times \frac{4}{15} = 16.4 \text{ m}$$

(c) The limiting flat portion of the curve describes the constant speed of the car, Therefore, portion of the graph between $t = 6 \text{ s}$ to 10 s , describes the uniform motion of the car.

9 State which of the following situations are possible and give an example for each of these.

(a) an object with a constant acceleration but with zero velocity

(b) an object moving in a certain direction with an acceleration in the perpendicular direction.

A (a) Free fall of an object.

(b) Object moving in a circular path

10 An artificial satellite is moving in a circular orbit of radius 42250 km . Calculate its speed if it takes 24 hours to revolve around the earth.

A Radius of the orbit = 42250 km

Time taken for one revolution = $24 \text{ hours} = 24 \times 60 \times 60 \text{ s}$

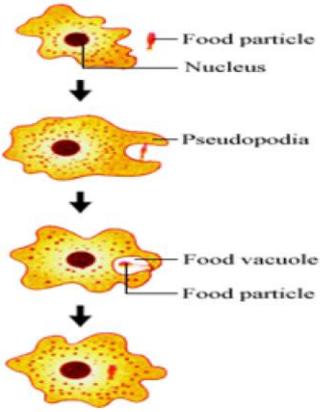
$$\begin{aligned} \therefore \text{ Speed} &= \frac{\text{distance}}{\text{time}} = \frac{2\pi r}{\text{time}} \\ &= 2 \times \frac{22}{7} \times \frac{42250 \times 1000}{24 \times 60 \times 60} \end{aligned}$$

$$\begin{aligned} \text{Speed} &= 3073.74 \text{ m s}^{-1} \\ &= 3.07 \text{ km s}^{-1}. \end{aligned}$$

Chapter 5

The Fundamental Unit of Life

Intext Questions: Page no 65	
Q.1	Can you name two organelles we have studied that contain their own genetic material? (To be marked in textbook)
Ans	The two organelles that have their own genetic material are: Mitochondria and Plastids
Q.2	If the organisation of a cell is destroyed due to some physical or chemical influence, what will happen? (To be marked in textbook)
Ans	If the organisation of a cell is destroyed due to some physical or chemical influence, then the cell will not be able to perform the basic functions like respiration, nutrition, excretion etc. This may stop all the life activities and may result in its death.
Q.3	Why are lysosomes known as suicide bags? (To be marked in textbook)
Ans	Lysosomes are known as suicide bags of the cell because they contain digestive enzymes capable of digesting cells and unwanted materials. The released enzymes can digest their own cell, causing the cell to die. As a result, they're known as suicide bags.
Q.4	Where are proteins synthesised inside the cell? (To be marked in textbook)
Ans	Proteins are synthesised by ribosomes which are RNA protein complexes.
Exercise Questions: Page no 67	
Q.5	Which organelle is known as the powerhouse of the cell? Why?
Ans	It is Mitochondria of the cell which is known as the power house of the cell, because it synthesizes energy in the form of ATP molecules during respiration which is vital for various life activities.
Q.6	Where do the lipids and proteins constituting the cell membrane get synthesised?
Ans	Endoplasmic reticulum is responsible for synthesis of lipids and protein constituting the cell membrane. The endoplasmic reticulum is of two types: i) Smooth endoplasmic reticulum (SER): It is responsible for the synthesis of lipids constituting cell membrane. ii) Rough endoplasmic reticulum (RER): It bears the ribosomes and is therefore responsible for the synthesis of proteins constituting cell membrane.
Q.7	How does an <i>Amoeba</i> obtain its food?

Ans	 <p>Amoeba feeds on microorganisms (like planktons) which float on water. It develops false feet or pseudopodia to surround the food. It captures the food within a sac like structure called the food vacuole inside which digestion of food takes place.</p>
Q.8	What is osmosis? (To be marked in textbook)
Ans	Osmosis is the movement of water (solvent) from a region of high-water concentration through a semi permeable membrane to a region of low concentration of water. It can take place only in liquid medium and not in solid or gases. Example is absorption of water from soil by plant roots.
Q.9	<p>Carry out the following osmosis experiment: Take four peeled potato halves and scoops each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water. Now,</p> <p>(a) Keep cup A empty (b) Put one teaspoon sugar in cup B (c) Put one teaspoon salt in cup C (d) Put one teaspoon sugar in the boiled potato cup D.</p> <p>Keep these for two hours. Then observe the four potato cups and answer the following: (To be discussed)</p>
	Explain why water gathers in the hollowed portion of B and C.
Ans	When we put one teaspoon sugar in cup B and one teaspoon salt in cup C, the hypertonic solution is formed inside the cups so water from outside enters inside due to osmosis and collects in the hollowed portion of cups B & C.
	Why is potato A necessary for this experiment?
Ans	Potato A in the experiment acts as a control set-up. No water gathers in the hollowed portions of potato A.
	Explain why water does not gather in the hollowed-out portions

	of A and D.
Ans	<p>Water does not gather in the hollowed portions of potato A because potato cup A is empty. It is a control set-up in the experiment.</p> <p>Water is not able to enter potato D because the potato used here is boiled. Boiling denatures the proteins present in the cell membrane and thus, disrupts the cell membrane. For osmosis, a semi-permeable membrane is required, which is disrupted in this case. Therefore, osmosis will not occur. Hence, water does not enter the boiled potato cup.</p>

Important Definitions and Terms

1	Cellular respiration: Cellular respiration is the process by which the food releases energy in the mitochondria. Cells absorb glucose from the food and burn it to produce energy.
2	Cell structure in Eukaryotic cells: Eukaryotic cells have the most well-defined structure. These cells have cell membrane, membrane bound cell organelles and a well-defined nucleus. The nucleus has its own membrane called nuclear membrane.
3	Cell membrane: Cell membrane is the outer covering of a cell. It is made up of phospho-lipid bilayer membrane and It is selectively permeable in nature.
4	Cell wall in plants: Plant cells are different from animals' cells due to the presence of a cell wall. The cell wall is made of cellulose and gives a rigid structure to the plant cell.
5	Nucleus in cells: Nucleus is the processing unit of the cell. It is a double membrane bound organelle which contains the genetic material for inheritance.
6	Chromosomes: During the growth phase of the cell, the chromatin condenses into a much thicker structure called chromosome.
7	Chromatin: Chromatin is a thread like structure which serves as the genetic material present inside the nucleus of the cell. It is made up of DNA and protein molecules. The DNA contains the hereditary information needed for the structure and function of the organism
8	Cytoplasm: Cytoplasm is the fluid found inside the cell. It gives the structure to the cell and houses different organelles of the cell.

9	Organelles: Organelles are structures present in the cytoplasm of the cell that help in several functions of the cell.
10	Endoplasmic Reticulum: Endoplasmic reticulum is a membrane like cell organelle that plays an integral role in the interpretation of the genetic information present in the nucleus.
11	Rough ER: Rough ER are the ones that have ribosomes on it. The ribosome is made up of nucleic acids and proteins. They are the site of protein synthesis. The Rough ER is also involved in the modification and folding of protein.
12	Smooth ER: Smooth ER do not have ribosomes and thus are not involved in protein synthesis. They are however, involved in the lipid metabolism and detoxifying poisonous molecules.
13	Golgi Apparatus: Golgi Apparatus is also called the post office of the cell. They package and transport the proteins across the cytoplasm
14	Lysosomes: They are referred to as suicide bags of the cell as they contain potent enzymes that can digest a cell. Lysosome also help in defence by attacking a foreign object.
15	Mitochondria: Mitochondria are also called power plant of the cell. They generate ATP via the electron transport chain. They also have a DNA called mtDNA, which makes them semi-autonomous organelle.
16	Plastids: There are various types of plastids in different cells based on the pigment they contain. The chloroplast is the plastid where the photosynthesis occurs. Some of the other plastids are leucoplast and chromoplast.
17	Vacuoles: Vacuoles are large vesicles that hold water or air in them and give structural rigidity to the cell. Vacuoles are common in plant cells. In animals the vacuoles are either very small or absent.
18	Endocytosis: The flexibility of the cell membrane enables the cell to engulf in food and other material from its external environment. Such processes are known as endocytosis.

Delhi Public School, Gandhinagar
Academic Session 2021-22

Class: IX

Subject: Science

CHAPTER-1

MATTER IN OUR SURROUNDINGS

Pg. No. 9

Q.4 Suggest a method to liquefy atmospheric gases (to be discussed in class)

A.4 By applying pressure and reducing the temperature, atmospheric gases can be liquified.

Pg. No. 10

Q.1 Why does a desert cooler cool better on a hot dry day?

A.1 On a hot dry day temperature of the atmosphere is high and humidity of air is low. Both these factors increase the rate of evaporation and thus enormous cooling is produced.

Q.2 How does the water kept in an earthen pot (matka) become cool during summer?

A.2 Earthen pot bears pores on it. During summers the water present on the surface of the earthen pot evaporates which causes the cooling effect. Evaporation occurs continuously and so a large amount of cooling is produced.

Q.3 Why does our palm feel cold when we put some acetone or petrol or perfume on it?

A.3 Acetone, petrol and perfume evaporates at low temperature. When some acetone is dropped on the palm it takes away the heat from the palm and evaporates making palm cooler.

Q.4 Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

A.4 A liquid attains a larger surface area in the saucer as compared to a cup. Since evaporation is a surface phenomenon, by using a saucer instead of cup we are increasing the surface area for evaporation to occur. Faster evaporation of particles of tea or milk allows cooling and taking a sip becomes easier.

Q.5 What type of clothes should we wear in summer?

A.5 Cotton is a good absorbent of water and hence it absorbs sweat quite well and pores in the fabric expose that sweat to the atmosphere, making evaporation faster. During this evaporation, particles on the surface of the liquid gain energy from our body surface, making the body cool hence we should prefer wearing cotton clothes in summer.

Exercises (Pg. No. 12)

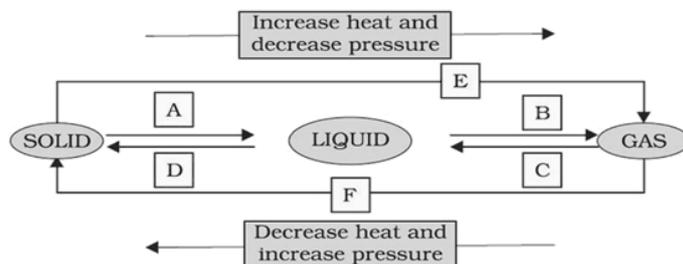
Q.7 **Why is ice at 273 K more effective in cooling than water at the same temperature?**

A.7 While melting, ice absorbs latent heat of fusion from the surroundings and gets changed into water that makes the cooling effect more intense as compared to water at same temperature.

Q.8 **What produces more severe burns, boiling water or steam?**

A.8 Steam at 373K has more heat energy equal to the latent heat of vaporisation than boiling water at 373K, therefore steam produces more severe burns than boiling water.

Q.9 **Name A, B, C, D, E and F in the following diagram showing change in its state.**



A.9 A → Melting

B → Vaporisation

C → Condensation

D → Solidification

E → Sublimation

F → Deposition

Extra Questions

Q.1 Why is ice rubbed on burnt part of the skin?

Q.2 Why does evaporation cause cooling?

Q.3 Which gas is called dry ice? Why?

Q.4 Alka was making tea in kettle. Suddenly she felt intense heat from the puff of steam gushing out of the spout of the kettle. She wondered whether the temperature of the steam was higher than that of the water boiling in the kettle. Comment.

Q.5 Why do the doctors advise to put strips of wet cloth on the forehead of a person having high fever?

Delhi Public School, Gandhinagar
Academic Session 2021-22

Class: IX

Subject: Science

CHAPTER-1

MATTER IN OUR SURROUNDINGS

Pg. No. 3

Q.1 Which of the following are matters? (to be discussed in class)

Chair, air, love, smell, hate, almonds, thought, cold, cold drink, smell of perfume.

A.1 Anything that occupies space and has mass is called matter. Matter can exist in three physical states—solid, liquid, and gaseous.

Chair and almond are forms of matter in the solid state.

Cold drink is a liquid state of matter.

Air and smell of perfume are gaseous states of matter.

Q.2 Give reasons for the following observation:

The smell of hot sizzling food reaches you several metres away, but to get the smell from cold food you have to go close.

A.2 The vapours (molecules) coming out from hot sizzling food has higher temperature than cold food and at higher temperature rate of diffusion is high, due to which the smell of hot sizzling food reaches us from several metres away.

Q.3 A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

A.3 A diver is able to cut through water in a swimming pool because:

i) The inter particle spaces is large in water.

ii) The inter particle force of attraction is low in water.

Q.4 What are the characteristics of particles of matter?

A.4 The characteristics of particles of matter are:

i) Particles of matter have spaces between them.

ii) Particles of matter are continuously moving.

iii) Particles of matter attract each other.

Pg. No. 6

Q.1 The mass per unit volume of a substance is called density. (density = mass/volume).

Arrange the following in order of increasing density – air, exhaust from chimneys, honey, water, chalk, cotton and iron. (to be discussed in class)

A.1 The given substances in the increasing order of their densities can be represented as:
Air < Exhaust from chimney < Cotton < Water < Honey < Chalk < Iron

Q.2 (a) Tabulate the differences in the characteristics of states of matter.

S.No	Property	Solid state	Liquid state	Gaseous state
1.	Shape and volume	Definite shape and volume	Indefinite shape but definite volume	Indefinite shape and volume
2.	Inter particle force of attraction	Strong inter particle force	Moderate inter particle force	Weak inter particle force
3.	Inter particle space	Negligible	Moderate	Very large
4.	Nature	Hard and rigid	Fluid	Fluid

(b) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy, and density.

- i) Rigidity can be expressed as the tendency of matter to resist a change in shape.
- ii) Compressibility is the ability to be reduced to a lower volume when force is applied.
- iii) Fluidity is the ability to flow.
- iv) By filling a gas container, we mean the attainment of shape of the container by gas.
- v) Shape defines a definite boundary.
- vi) Kinetic energy is the energy possessed by a particle due to its motion.
- vii) Density is mass per unit volume.

Q.3 Give reasons:

(a) A gas fills completely the vessel in which it is kept.

The force of attraction between particles of a gas is negligible hence particles freely move/flow in all possible directions as a result a gas fills completely the vessel in which it is kept.

(b) A gas exerts pressure on the walls of the container.

Particles of gas move randomly in all directions at high speed. As a result the particles collide with each other and also hit the wall of the container with a force. Therefore, gas exerts pressure on the walls of the container.

(c) A wooden table should be called a solid.

The wooden table is quite rigid, its particles have a fixed location and it also possess a definite shape and volume. Due to all these properties we should call a wooden table a solid substance.

- (d) **We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert.**

Particles of the air have large spaces between them and weak force of attraction. On the other hand, in wood particles are closely packed and have strong interparticle force of attraction. As a result, we can move our hand in air but to do the same through a solid block of wood we need a karate expert.

Q.4 Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why.

A.4 Ice has cage-like structures, when water freezes to form ice and some empty spaces known as voids are created. As a result, volume increases for the same mass of water. In other words, mass per unit volume or density of ice is lower than that of water and hence ice floats over water.

Pg. No. 9

Q.1 Convert the following temperature to Celsius scale:

a) 300 K b) 573 K

A.1 (a) $300\text{ K} = 300 - 273$
 $= 27^{\circ}\text{C}$

(b) $573\text{ K} = 573 - 273^{\circ}\text{C}$
 $= 300^{\circ}\text{C}$

Q.2 What is the physical state of water at: a) 250°C b) 100°C

A.2 (a) Water at 250°C exists in gaseous state.

(b) At 100°C, water can exist in both liquid and gaseous form.

Q.3 For any substance, why does the temperature remain constant during the change of state?

A.3 During a change of state, the temperature remains constant. This is because all the heat supplied to increase the temperature is utilised (as latent heat of vaporization or latent heat of fusion) in changing the state by overcoming the forces of attraction between the particles. Therefore, the temperature remains constant.

Exercise

Q.1 Convert the following temperatures into the Celsius scale. (a) 293 K (b) 470 K

A.1 (a) $293\text{ K} = 293 - 273$

$$= 20^{\circ}\text{C}$$

(b) $470\text{ K} = 470 - 273$
 $= 197^{\circ}\text{C}$

Q.2 Convert the following temperatures into the Kelvin scale.

(a) 25°C (b) 373°C

A.2 $\text{K} = ^{\circ}\text{C} + 273$

$$= 25 + 273$$

$$= 298\text{ K}$$

$$\text{K} = ^{\circ}\text{C} + 273$$

$$= 373 + 273$$

$$= 646\text{ K}$$

Q.3 Give reason for the following observations.

(a) **Naphthalene balls disappear with time without leaving any solid.**

Naphthalene shows the property of sublimation. Evaporation of naphthalene takes place easily and so it disappears during course of time without leaving a solid.

(b) **We can get the smell of perfume sitting several metres away.**

Perfume being a volatile substance (gets evaporated easily) changes from liquid to gaseous state very fast and its vapours diffuse into air easily. That is why we can smell perfume sitting several meters away.

Q.4 Arrange the following substances in increasing order of forces of attraction between the particles— water, sugar, oxygen. (to be discussed in class)

A.4 Oxygen < water < sugar.

Q.5 What is the physical state of water at—

(a) 25°C (b) 0°C (c) 100°C ?

A.5 At 25°C water is liquid, at 0°C water exists as both solid and liquid, at 100°C water exists as both liquid and gas.

Q.6 Give two reasons to justify—

A.6 (a) Water at room temperature is a liquid.

Water is liquid at room temperature because at this temperature

(i) it has fixed volume and (ii) it can flow.

(b) **An iron almirah is a solid at room temperature.**

An iron almirah is solid at room temperature because at this temperature

(i) It has definite shape along with fixed volume and (ii) It cannot flow like water and hence does not possess fluidity

Lesson Name: Matter in Our Surroundings

Chapter 1

Extra Questions 2021-22

- Q.1** Write two properties of matter which are responsible for the different physical state of matter.
- Q.2** When solids melt, its temperature remains constant. Explain.
- Q.3** Describe an activity to show that particles of matter have spaces between them.
- Q.4** When 50g of sugar is dissolved in 100ml of water, there is no increase in the volume. What characteristic of matter is illustrated by this observation?
- Q.5** What happens when, an inflated balloon is kept in sun for some time? Why?

Chapter 5

The fundamental unit of life

Exercise-5.1 (Page: 59)

1. Who discovered cells, and how?

Answer:

In 1665, Robert Hooke discovered cells while examining a thin slice of cork through a self-designed microscope. He observed that the cork resembled the structure of a honeycomb consisting of numerous tiny compartments. He then referred to the miniscule boxes as cells.

2. Why is the cell called the structural and functional unit of life?

Answer:

Cells form the structure of an entity. A group of cells form a tissue, further an organ and ultimately an organ system. They perform fundamental functions and life processes such as respiration, digestion, excretion etc in both unicellular and multicellular organisms. They perform all the activities independently. Hence, cells are referred to as structural and fundamental units of life.

Exercise-5.2.1 (Page: 61)

1. How do substances like CO₂ and water move in and out of the cell?

Answer:

CO₂ moves by diffusion - These cellular waste accumulates in high concentrations in the cell, whereas the concentration of CO₂ in the external surroundings is comparatively lower. This difference in the concentration level inside and out of the cell causes the CO₂ to diffuse from a region of higher (within the cell) to a lower concentration.

H₂O diffuses by osmosis through the cell membrane. It moves from a region of higher concentration to a lower concentrated region through a selectively permeable membrane until equilibrium is reached.

2. Why is the plasma membrane called a selectively permeable membrane?

Answer:

The plasma membrane is called as a selectively permeable membrane as it permits the movement of only certain molecules in and out of the cells. Not all molecules are free to diffuse.

Exercise 5.2.4 (Page 63)

1. Write the differences between Prokaryotic and Eukaryotic cell (fill in the blanks)

Prokaryotic Cell	Eukaryotic Cell
1. Size: Generally small (1-10 μm) $1 \mu\text{m} = 10^{-6}\text{m}$ 2. The nuclear region is poorly defined due to the absence of a nuclear membrane and known as the nucleoid. 3. There is a single chromosome. 4. Membrane-bound cell organelles absent.	1. Size: Generally large (5-100 μm) 2. Nuclear region: well defined and surrounded by a nuclear membrane. 3. There are more than one chromosomes. 4. Membrane-bound cell organelles present.

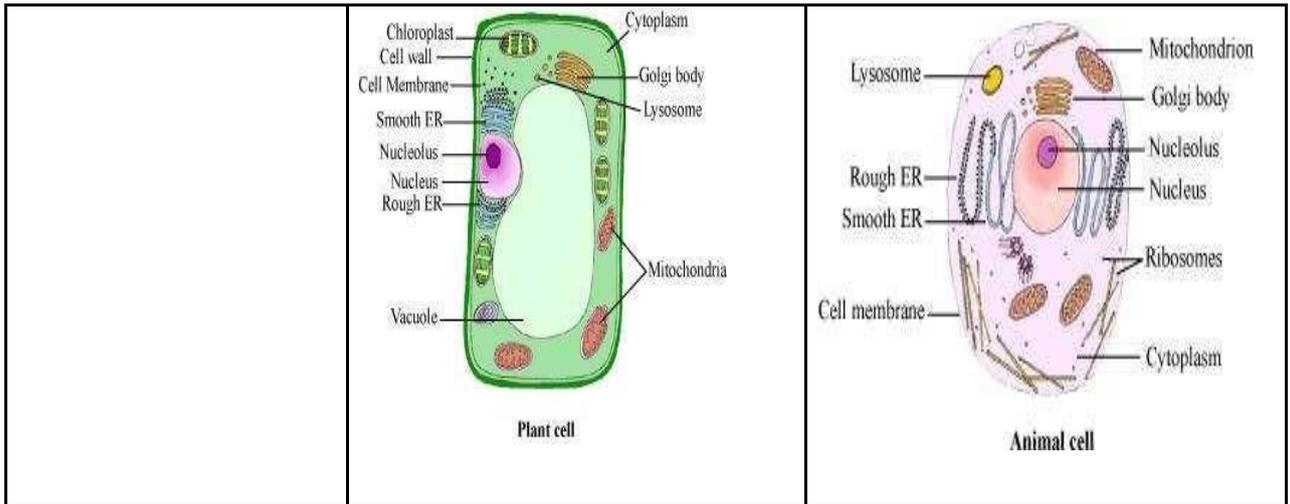
Exercise Question (Page: 67)

1. Make a comparison and write down ways in which plant cells are different from animal cells.

Answer

The following table depicts the differences between plant cells and animal cells.

Characteristic	Plant Cell	Animal Cell
Cell wall	Present	Absent
Shape of cell	Distinct edges, shape is either rectangular or square shaped.	Round and irregular shape
Nucleus	Present. Lies on one side of the cell	Present. Lies in the center of the cell
Lysosomes	Rarely present	Always present
Plastids	Present	Absent
Structure of Vacuoles	Single or a few large vacuole that is centrally located	Presence of numerous and small vacuoles



2. How is prokaryotic cell different from a eukaryotic cell?

Answer:

The following are the differences between prokaryotic and eukaryotic cells.

Prokaryotic Cell	Eukaryotic Cell
<ol style="list-style-type: none"> 1. Size: Generally small (1-10 μm) $1 \mu\text{m} = 10^{-6}\text{m}$ 2. The nuclear region is not well defined as the nuclear membrane is absent and is referred to as the nucleoid. 3. There is a single chromosome. 4. Membrane-bound cell organelles absent. 	<ol style="list-style-type: none"> 1. Size: Generally large (5-100 μm) 2. Nuclear region: well defined and girdled by a nuclear membrane. 3. There are more than one chromosomes. 4. Membrane-bound cell organelles present.
<p>PROKARYOTIC CELLS</p>	

3. What would happen if the plasma membrane ruptures or breaks down?

Answer:

If plasma membrane ruptures or breaks down then molecules of some substances will freely move in and out of the cells. As plasma membrane acts as a mechanical barrier, exchange of material from its surroundings through osmosis or diffusion in a cell won't take place. Consequently, the cell would die due to the disappearance of the protoplasmic material.

4. What would happen to the life of a cell if there was no Golgi apparatus?

Answer:

The Golgi apparatus consists of stacks of membrane-bound vesicles whose functions are as follows:

- storage of substances
- packaging of substances
- manufacture of substances

Without the Golgi apparatus, the cells will be disabled from packing and dispatching materials that were produced by the cells. The golgi apparatus is also involved in the formation of cells. Hence, in the absence of golgi apparatus, cells will not be produced.

Additional Study Material

Scientists and their contribution (Important Discoveries)

1.Robert Hooke: - First discovered cells (dead cells) in a cork slice using primitive microscope.

2.Antony Van Leeuwenhoek: - First discovered living cell in pond water using simple light microscope. He called these cells "**small animalcules**".

3.Robert Brown: - Discovered nucleus.

4.J. E. Purkinje (1839): - Coined the term **protoplasm** for the fluid substance of the cell.

5.Schleiden (1838) and Schwann (1839): - They proposed **Cell theory**, that stated-

- i. All plants and animals are composed of cells and cellular products.
- ii. The cell is the basic unit of life.

Viruses are exception to cell theory.

6.Nucleolus: Spherical body present in the nucleus, which is the site of ribosome synthesis is called nucleolus.

7.Nucleoplasm: Liquid contents of the nucleus is called nucleoplasm.

Important Differences

A OSMOSIS AND DIFFUSION

	Diffusion	Osmosis
1	Movement of ions or molecules from a region of higher concentration to a region of its lower concentration.	Movement of solvent molecules from a region of higher concentration to its lower concentration through a semi-permeable.
2	Occurs in both air and liquid medium	Occurs only in liquid medium
3	Concentration equilibrium Can be maintained	Concentration equilibrium cannot be maintained

B	<u>ROUGH ENDOPLASMIC RETICULUM AND SMOOTH ENDOPLASMIC RETICULUM:</u>		
	Characteristics	Rough Er	Smooth Er
	Ribosomes	Attached to cisternae	Absent
	Function	Protein synthesis	Steroid and lipid synthesis
	Occurrence	Abundance in protein secreting cells like pancreatic cells, fibroblast, liver cells etc.	Abundance in lipid and sterol secreting cells like intestine cells, leucocytes etc.
	Also known as	Granular ER	Agranular endoplasmic reticulum
	Connection	Continuous with nuclear membrane	Continuous with golgi complex and plasma membrane

Important Definitions/ Terms:

Impermeable membrane: If a membrane does not permit movement of solute and solvent molecules, is called impermeable membrane.

Isotonic solution: When the concentration of the solutes on both sides of cell membrane are same, the solution is called isotonic solution.

Hypotonic solution:When the concentration of the solute in the solution is lower than intracellular fluid i.e. cytoplasm and cell sap, the solution is called hypotonic solution.

Hypertonic solution:When the concentration of the solute in the solution is higher than intracellular fluid i.e. cytoplasm and cell sap, the solution is called hypertonic solution.

Endosmosis: When cells are placed in hypotonic solution, water flows into the cell. This process of osmotic entry of water is called endosmosis.

Exosmosis:When cells are placed in hypertonic solution, water flows out of the cell. This process of osmotic withdrawal of water is called exosmosis.

Plasmolysis: Shrinkage of plasma membrane and cell contents away from the cell wall due to exosmosis is called plasmolysis.

Deplasmolysis: Regain of turgidity by a plasmolysed cell because of endosmosis is deplasmolysis.

Chromatin material: Thin thread like intertwined mass of filament present in the nucleoplasm is called chromatin material.

Chromosomes: Condensed chromatin material which contain genes in a linear order is called chromosomes.

Genes: Segment of DNA (Deoxyribonucleic acid) on chromosomes, responsible for inheritance of characters through successive generations. Such segments of DNA are called genes.

CLASS-IX SCIENCE(PHYSICS)
CHAPTER-8 MOTION

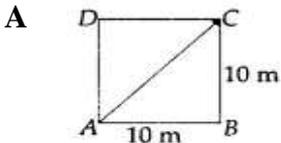
INTEXT QUESTIONS:

1 An object has moved through a distance. Can it have zero displacement? If yes support your answer with an example.

A Yes, an object moving through a distance can have zero displacement. This happens when final position of the object coincides with its initial position.

Example: If an object travels from point A and reaches to the same point A, then its displacement is zero.

2 A farmer moves along the boundary of a square field of side 10 m in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds?



Time for one round = 40 s

Total time = 2 min 20 s
= (2 × 60 + 20) s = 140 s

Number of round completed = $\frac{140}{40} = 3.5$

If farmer starts from A, it will complete 3 rounds (A → B → C → D → A) at A.

In the last 0.5 round starting from A, he will finish at C.

Displacement of farmer

$$= AC = \sqrt{AB^2 + BC^2} = \sqrt{10^2 + 10^2} = 10\sqrt{2} \text{ m}$$

3 Which of the following is true for displacement?

(a) It cannot be zero.

(b) Its magnitude is greater than the distance travelled by the object.

A (a) False

(b) False

4 Distinguish between speed and velocity.

A **Speed**

It is the ratio of distance to time.

It is scalar quantity.

It is always positive.

Velocity

It is the ratio of displacement to time.

It is vector quantity.

It can be positive, negative or zero.

5 Under what condition(s) is the magnitude of average velocity of an object equal to its average speed?

A The magnitude of average velocity of an object is equal to its average speed if the object moves in a straight line in a particular direction.

6 What does an odometer of an automobile measure?

A The odometer of an automobile measures the distance travelled by a vehicle.

7 What does the path of an object look like when it is in uniform motion?

A In uniform motion, the path of an object can be a straight line.

8 During an experiment, a signal from a spaceship reached the ground station in five minutes. What was the distance of the spaceship from the ground station? The signal travels at the speed of light that is $3 \times 10^8 \text{ m s}^{-1}$.

A Time taken = 5 minutes = $5 \times 60 \text{ s} = 300 \text{ s}$

Speed of signal, $u = 3 \times 10^8 \text{ m s}^{-1}$

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

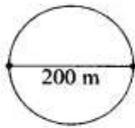
$$\therefore \text{Distance} = \text{speed} \times \text{time}$$

$$= 3 \times 10^8 \times 300 = 9 \times 10^{10} \text{ m}$$

NCERT EXERCISE QUESTIONS:

- 1 An athlete completes one round of a circular track of diameter 200 m in 40 s. What will be the distance covered and the displacement at the end of 2 minutes 20 s?

A



$$\text{Diameter, } d = 200 \text{ m, } r = \frac{d}{2} = 100 \text{ m}$$

$$\text{Time for one round} = 40 \text{ s}$$

$$\text{Distance travelled in 2 minutes and 20 s}$$

$$(2 \times 60 + 20 = 140 \text{ s}) = \frac{140}{40} = 3.5 \text{ rounds}$$

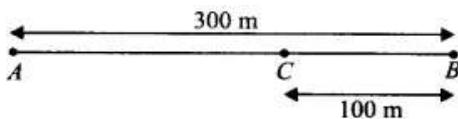
$$\text{Distance travelled} = \text{Circumference of the circle} \times 3.5$$

$$= 2\pi r \times 3.5$$

$$= 2 \times \frac{22}{7} \times 100 \times 3.5 = 2200 \text{ m}$$

- 2 Joseph jogs from one end A to the other end B of a straight 300 m road in 2 minutes 30 seconds and then turns around and jogs 100 m back to point C in another 1 minute. What are Joseph's average speeds and velocities in jogging, (a) from A to B and (b) from A to C?

A (a) from A to B



$$\text{Time for A to B} = 2 \text{ min } 30 \text{ s}$$

$$= 2 \times 60 + 30 = 150 \text{ s}$$

$$\text{Average speed} = \frac{\text{total distance}}{\text{time interval}}$$

$$= \frac{300}{150} = 2 \text{ m s}^{-1}$$

$$\text{Average velocity} = \frac{\text{displacement}}{\text{time interval}}$$

$$= \frac{300}{150} = 2 \text{ m s}^{-1}$$

(b) from A to C

$$\therefore \text{Average speed} = \frac{\text{total distance}}{\text{time interval}}$$

$$= \frac{400}{210} = 1.9 \text{ m s}^{-1}$$

$$\therefore \text{Average velocity} = \frac{\text{displacement}}{\text{time interval}}$$

$$= \frac{200}{210} = 0.95 \text{ m s}^{-1}$$

- 3 Abdul, while driving to school, computes the average speed for his trip to be 20 km h⁻¹. On his return trip along the same route, there is less traffic and the average speed is 30 km h⁻¹. What is the average speed for Abdul's trip?

$$t_1 = \frac{\text{distance}}{\text{average speed}} = \frac{x}{20}$$

If t_2 is time taken to reach back, then

A
$$t_2 = \frac{\text{distance}}{\text{average speed}} = \frac{x}{30}$$

Total time,

$$t = t_1 + t_2 = \frac{x}{20} + \frac{x}{30} = x \left[\frac{1}{20} + \frac{1}{30} \right] = \frac{5x}{60} = \frac{x}{12}$$

- 10 An artificial satellite is moving in a circular orbit of radius 42250 km. Calculate its speed if it takes 24 hours to revolve around the earth.

A Radius of the orbit = 42250 km

$$\text{Time taken for one revolution}$$

$$= 24 \text{ hours} = 24 \times 60 \times 60 \text{ s}$$

$$\text{Total distance } x + x = 2x$$

$$\text{Average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{2x}{x/12} = 24 \text{ km h}^{-1}$$

$$\therefore \text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{2\pi r}{\text{time}}$$

$$= 2 \times \frac{22}{7} \times \frac{42250 \times 1000}{24 \times 60 \times 60}$$

$$\text{Speed} = 3073.74 \text{ m s}^{-1}$$

$$= 3.07 \text{ km s}^{-1}$$



Delhi Public School, Gandhinagar

Academic Session-2021-22

Class 9

Subject: Science

CHAPTER-3

ATOMS AND MOLECULES

Pg. No. 32

Q.1 **In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass.**

sodium carbonate + ethanoic acid → sodium ethanoate + carbon dioxide + water

A.1 According to the law of conservation of mass:

Mass of reactants = Mass of products

Mass of reactants = Mass of sodium carbonate + Mass of ethanoic acid

$$= 5.3\text{g} + 6\text{g}$$

$$= 11.3\text{g}$$

Mass of products = Mass of sodium ethanoate + Mass of CO₂ + Mass of H₂O

$$= 8.2\text{g} + 2.2\text{g} + 0.9\text{g}$$

$$= 11.3\text{g}$$

Hence it is proved that these observations are in agreement with the law of conservation of mass.

Q.2 **Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?**

A.2 As per the given 1:8 ratio, mass of oxygen gas required to react completely with 1g of hydrogen gas is 8g.

Therefore, mass of oxygen gas required to react completely with 3g of hydrogen gas will be = 3 x 8 = 24g

Q.3 **Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?**

A.3 The following postulate of Dalton's atomic theory is a result of the law of conservation of mass:

"Atoms are indivisible particles which cannot be created or destroyed in a chemical reaction."

Q.4 **Which postulate of Dalton's atomic theory can explain the law of definite proportions?**

A.4 The following postulate of Dalton's atomic theory can explain the law of definite proportions:

"The relative number and kinds of atoms are constant in a given compound."

(Page No. 35) (to be discussed in the class)

Q.1 **Define the atomic mass unit.**

Atomic mass unit is defined as the mass equal to exactly one-twelfth (1/12th) of the mass of an atom of carbon-12.

Q.2 **Why is it not possible to see an atom with naked eyes?**

A.2 An atom is an extremely small particle whose radius is of the order 10^{-10} m. This size is so small that our eyes are not able to see it.

(Exercise)

Q.1 **A 0.24 g sample of a compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g of oxygen. Calculate the percentage composition of the compound by weight.**

A.1 Mass of the given sample compound = 0.24g

Mass of boron in the given sample compound = 0.096g

Mass of oxygen in the given sample compound = 0.144g

% composition of compound = % of boron and % of oxygen

Therefore % of boron = mass of boron \times 100/mass of the sample compound

$$= \frac{0.096 \times 100}{0.24}$$

$$= 40\%$$

Therefore % of oxygen = mass of oxygen \times 100/mass of the sample compound

$$= \frac{0.144 \times 100}{0.24}$$

$$= 60\%$$

Or % of oxygen = Total % - % of boron = 100 - 40 = 60%

Q.2 **When 3.0 g of carbon is burnt in 8.00 g oxygen, 11.00 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.00 g of carbon is burnt in 50.00 g of oxygen? Which law of chemical combination will govern your answer?**

A.2 According to the law of chemical combination of constant proportions "In a chemical compound the elementary constituents always combine in constant proportions by weight/mass". Therefore, whether 3 g carbon is burnt in 8 g oxygen or 3g carbon is burnt in 50g oxygen, in both the cases only 11g carbon dioxide will be formed. The remaining 42g oxygen (50g-8g) will remain unreacted.

CLASS-IX- SCIENCE (PHYSICS)

CHAPTER-10 GRAVITATION

FOR FAIR NOTEBOOK WORK

In-text Questions

1) State the universal law of gravitation.[Page No.134]

- The law of gravitation states that the force of attraction between any two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

2) Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth. [Page No.134]

- Let the mass of earth = M.

Let the mass of the object = m.

Distance between the earth's centre and object's centre = Radius of the earth = R.

Therefore, Gravitational Force = $F = \frac{GmM}{R^2}$

3) What do you mean by free fall? [Page No.136]

- Any object that is being acted upon only by the force of gravity is said to be in a state of free fall.

4) What do you mean by acceleration due to gravity? [Page No.136]

- If an object falls freely towards the surface of earth from a certain height then its velocity changes at uniform rate. This change in velocity produces acceleration in the object which is known as acceleration due to gravity. The value of acceleration due to gravity is $g = 9.8 \text{ m/s}^2$.

5) What are the differences between the mass of an object and its weight? [Page No.138]

- Difference is given below:

Mass	Weight
It is the actual amount of material contained in a body.	It is the force exerted by the gravity on the body.
It is measured in kilogram, gram etc.	It is measured in newton.
It is denoted by m or M.	It is denoted by W.
It is always constant for body.	It varies from place to place for body.
It is a fundamental physical quantity.	It is a derived physical quantity.

6) Why is the weight of an object on the moon $1/6^{\text{th}}$ its weight on the earth? [Page No.138]

- The earth's mass (M_e) is $6 \times 10^{24} \text{ kg}$

The moon's mass (M_m) is $7.4 \times 10^{22} \text{ kg}$

$$\therefore \frac{M_e}{M_m} = \frac{6 \times 10^{24}}{7.4 \times 10^{22}}$$

$$\therefore \frac{M_e}{M_m} = 0.81 \times 10^2 = 81$$

$$\therefore M_e = 81 M_m$$

The earth's radius (R_e) is 6.4×10^3 km

The moon's radius (R_m) is 1.7×10^3 km

$$\therefore \frac{R_e}{R_m} = \frac{6.4 \times 10^3}{1.7 \times 10^3}$$

$$\therefore \frac{R_e}{R_m} = 3.8$$

$$\therefore R_e = 3.8 R_m$$

$$g_e = \frac{GM_e}{R_e^2}$$

$$g_e = \frac{G \times 81M_m}{(3.8)^2 R_m^2}$$

$$g_e = \frac{81 \times GM_m}{14.4 R_m^2}$$

$$g_e = 5.6 g_m = 6 g_m (\text{Approx.}) \left(g_m = \frac{GM_m}{R_m^2} \right)$$

$$g_m = \frac{1}{6} g_e$$

$$mg_m = \frac{1}{6} mg_e$$

$$W_m = \frac{1}{6} W_e$$

Exercise: [Page No.143-144]

1) How does the force of gravitation between two objects change when the distance between them is reduced to half?

➤ According to Universal Law of gravitation, the gravitational force of attraction between any two objects of masses M and m be

$$F = \frac{GmM}{r^2}$$

And r be the distance between two masses

If the distance between them is halved, then new distance

$$r^1 = r/2$$

$$\text{New force } F' = \frac{GmM}{(r^1)^2}$$

$$F' = \frac{GmM}{(r/2)^2}$$

$$F' = 4 \frac{GmM}{r^2}$$

$$F' = 4F$$

When the distance between the masses is reduced to half, the gravitational force increases by 4 times than the original one.

2) Gravitational force acts on all objects in proportion to their masses. Why then, a heavy object does not fall faster than a light object?

➤ A heavy object falls faster than a light object in the presence of air resistance because the heavy body faces air resistance lesser than the light body but when we don't consider air resistance (vacuum) then both heavy and light object will reach to the ground at the same time. Also, all objects fall from height with constant acceleration called acceleration due to gravity.

3) What is the magnitude of the gravitational force between the earth and a 1 kg object on its surface? (Mass of the earth is 6×10^{24} kg and radius of the earth is 6.4×10^6 m.)

➤ $M = 6 \times 10^{24}$ kg

$m = 1$ kg

$R = 6.4 \times 10^6$ m

Gravitational force between earth and the object is given by -

$$F = \frac{GmM}{R^2}$$

$$F = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6.4 \times 10^6)^2}$$

$F = 9.77$ N = 9.8 N (Approx.)

Therefore, gravitational force between the earth and an object is 9.8 N.

4) The earth and the moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as the force with which the moon attracts the earth? Why?

➤ The value of F is same for earth and the moon. Both bodies will exert the same amount of force on each other. As per universal law of gravitation, everybody attracts the other body with some force and this force is same for both the bodies called gravitational force.

5) If the moon attracts the earth, why does the earth not move towards the moon?

➤ The moon attracts the earth with the same gravitational force as the earth attracts the moon. Since the mass of earth is very large, the acceleration produced is negligible. Therefore, the earth does not move towards the moon.

6) What happens to the force between two objects, if

(i) the mass of one object is doubled? $2F$

(ii) the distance between the objects is doubled and tripled? $\frac{F}{4}$ and $\frac{F}{9}$

(iii) the masses of both objects are doubled? $4F$

7) What is the importance of universal law of gravitation?

- The gravitational force of attraction of the earth binds all terrestrial objects to the Earth.
- It explains the attractive force between any two objects which have mass.
- It explains the force that bind us to the Earth
- The motion of the moon around the Earth
- The motion of the planets around the sun.
- The tides due to the moon and the sun in the ocean on the earth.

8) What is the acceleration of free fall?

- 9.8 m/s^2

9) What do we call the gravitational force between the earth and an object?

- Weight

10) Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator. Will the friend agree with the weight of gold bought? If not, why? [Hint: The value of g is greater at the poles than at the equator.]

- Let m be the mass of the gold bought.

Also, let the acceleration due to gravity at poles and at equator be g_p and g_e respectively.

Acceleration due to gravity at poles is slightly greater than that at equator.

Weight of gold at the poles: $W_p = m g_p$

Weight of gold at equator: $W_e = m g_e$

But as $g_p > g_e \Rightarrow W_p > W_e$

Hence the weight of gold is slightly less at equator.

So, the friend will not agree with Amit about the weight of gold bought.

12) Gravitational force on the surface of the moon is only 1/6 as strong as gravitational force on the earth. What is the weight in newton of a 10 kg object on the moon and on the earth?

- Mass of the object = 10 kg

Weight of the object on earth = $W = m \times g$

$$\therefore W = 10 \times 9.8$$

$$W = 98 \text{ N}$$

Weight of the object on moon is $1/6^{\text{th}}$ weight on the earth.

$$\therefore \text{Weight of the object on moon} = 1/6 \times 98 = 16.3 \text{ N}$$

13) A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate

(a) the maximum height to which it rises,

(b) the total time it takes to return to the surface of the earth.

Initial velocity of the ball (u) = 49 m/s.

The velocity of the ball at maximum height (v) = 0 m/s

$$g = 9.8 \text{ m/s}^2$$

Let us consider the time taken is t to reach the maximum height H .

Consider a formula,

$$2gH = v^2 - u^2$$

$$2 \times (-9.8) \times H = 0 - (49)^2$$

$$-19.6 H = -2401$$

$$H = 122.5 \text{ m}$$

Now consider a formula,

$$v = u + g \times t$$

$$0 = 49 + (-9.8) \times t$$

$$-49 = -9.8t$$

$$t = 5 \text{ s}$$

(a) The maximum height to ball rises = 122.5 m

(b) The total time ball takes to return to the surface of the earth = $5 + 5 = 10 \text{ s}$

14) A stone is released from the top of a tower of height 19.6 m. Calculate its final velocity just before touching the ground.

➤ Initial Velocity $u = 0 \text{ m/s}$

Final velocity $v = ?$

Height, $s = 19.6 \text{ m}$

By third equation of motion

$$v^2 - u^2 = 2gs$$

$$v^2 = u^2 + 2gs$$

$$v^2 = 0 + 2 \times 9.8 \times 19.6$$

$$v^2 = 19.6 \times 19.6$$

$$v^2 = (19.6)^2$$

$$\Rightarrow v = 19.6 \text{ m/s}$$

15) A stone is thrown vertically upward with an initial velocity of 40 m/s. Taking $g = 10 \text{ m/s}^2$, find the maximum height obtained by the stone. What are the net displacement and the total distance covered by the stone?

➤ Initial Velocity $u = 40 \text{ m/s}$

Final velocity $v = 0 \text{ m/s}$

Height, $s = ?$

By third equation of motion

$$v^2 - u^2 = 2gs$$

$$0 - 40^2 = -2 \times 10 \times s$$

$$s = 1600/20$$

$$\Rightarrow s=80 \text{ m}$$

Total distance travelled by stone = upward distance + downward distance = $80 + 80 = 160 \text{ m}$

Total Displacement = 0, since, the initial and final point is same.

16) Calculate the force of gravitation between the earth and the Sun, given that the mass of the earth = $6 \times 10^{24} \text{ kg}$ and of the Sun = $2 \times 10^{30} \text{ kg}$. The average distance between the two is $1.5 \times 10^{11} \text{ m}$.

➤ Mass of earth = $6 \times 10^{24} \text{ kg}$

Mass of sun = $2 \times 10^{30} \text{ kg}$

Distance between earth and sun, $r = 1.5 \times 10^{11} \text{ m}$

$$F = \frac{GmM}{r^2}$$

$$F = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 2 \times 10^{30}}{(1.5 \times 10^{11})^2}$$

$$= 35.57 \times 10^{21} \text{ N}$$

$$= 3.557 \times 10^{22} \text{ N}$$

$$= 3.6 \times 10^{22} \text{ N}$$

17) A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 m/s. Calculate when and where the two stones will meet.

➤ Let t = time after which both stones meet

S = distance travelled by the stone dropped from the top of a tower

$(100-S)$ = distance travelled by the projected stone.

For stone dropped from the top of tower

$$-S = 0 + \frac{1}{2} (-10) t^2$$

$$\text{or, } S = 5t^2 \text{ ----(1)}$$

For stone projected upward

$$(100 - S) = 25t + \frac{1}{2} (-10) t^2 = 25t - 5t^2 \text{ -----(2)}$$

Adding (1) and (2), We get

$$100 = 25t$$

$$\text{or } t = 4 \text{ s}$$

Therefore, Two stones will meet after 4 s.

Put value of $t = 4 \text{ s}$ in Equation (1), we get

$$S = 5 \times 16 = 80 \text{ m.}$$

Thus, both the stone will meet at a distance of 80 m from the top of tower.

18) A ball thrown up vertically returns to the thrower after 6 s. Find

(i) the velocity with which it was thrown up,

- Time to reach Maximum height,

$$t = 6/2 = 3 \text{ s.}$$

$$v = 0 \text{ (at the maximum height)}$$

$$a = -9.8 \text{ m/s}^2$$

Using, $v = u + at$, we get

$$0 = u - 9.8 \times 3$$

$$0 = u - 29.4$$

$$u = 29.4 \text{ m/s}$$

(ii) the maximum height it reaches, and

- Thus, the velocity with which it was thrown up = 29.4 ms^{-1}

Using, $2aS = v^2 - u^2$, we get

$$S = \frac{v^2 - u^2}{2a}$$

$$= \frac{0 - (29.4)^2}{2 \times (-9.8)}$$

$$= \frac{-864.36}{-19.6}$$

$$= 44.1 \text{ m}$$

Thus, Maximum height it reaches = 44.1 m

(iii) its position after 4 s.

- Here, $t = 4 \text{ s}$. In 3 s , the ball reaches the maximum height and in 1 s it falls from the top.

Distance covered in 1 s from maximum height,

$$S = ut + \frac{1}{2} at^2$$

$$= 0 + \frac{1}{2} \times 9.8 \times 1$$

$$= 4.9 \text{ m}$$

Therefore, The ball will be 4.9 m below the top of the tower after 4 s .

CHAPTER-13

WHY DO WE FALL ILL?

Intext Questions: Pg. No. 178

Q.1 State any two conditions essential for good health.

Ans Two conditions essential for good health are:

- Better sanitation or clean surroundings, and
- Availability of sufficient and nutritious food.

Q.2 State any two conditions essential for being free of disease.

Ans Two conditions essential for being free of disease:

- Living in hygienic environment
- Getting vaccinated against common infectious diseases.

Q.3 Are the answers to the above questions necessarily the same or different? Why? (To be discussed/marked)

Ans Answers of above question (1, 2) are interconnected but different. It is because being disease free does mean being healthy.

Intext Questions: Pg. No. 180

Q.1 List any three reasons why you would think that you are sick and ought to see a doctor. If only one of these symptoms were present, would you still go to the doctor? Why or why not? (To be discussed/marked)

Ans If we have fever, headache, stomach-ache, loose motions, cough and sneeze etc we feel weak. Then we would feel that we are sick and ought to see a doctor. If only one of these symptoms is present, we should still go to see the doctor. Any of these symptoms may be initial signs of a severe disease.

Q.2 In which of the following case do you think the long-term effects on your health are likely to be most unpleasant?

- if you get jaundice,
- if you get lice,
- if you get acne. Why?

Ans The long-term effects on our health are likely to be most unpleasant if we get jaundice because the symptoms severely affect our internal organs and persist for long time. In contrast to jaundice, lice can be removed easily with short treatment and so is the acne. Both of these do not produce long term effects on the body.

Intext Questions: Pg. No. 187

Q.1 Why we are normally advised to take bland and nourishing food when we are sick?

Ans We are normally advised to take bland and nourishing food when we are sick because we are weak during illness and need complete nourishment for faster recovery. Such a food is easily digested and replenishes our lost vitamins, minerals and other nutrients along with energy.

Q.2 What are the different means by which infectious diseases are spread?

Ans Infectious diseases can be spread by following means:

(i) Direct Transmission

- a) Direct contact
- b) Contact with soil
- c) Through animal bites
- d) Transplacental transmission

(ii) Indirect Transmission

- a) Through contaminated food and water
- b) Through air
- c) Through vectors or carriers (housefly, mosquito etc)
- d) Through fomites

Q.3 What precautions can you take in your school to reduce the incidence of infectious diseases? (To be discussed/marked)

Ans To reduce the incidence of infectious diseases in my school the precautions will include:

- (i) Washing our hands properly before eating.
- (ii) Avoiding coming to school when one is affected with a communicable disease.
- (iii) Using a handkerchief while sneezing or coughing.
- (iv) Vaccinating oneself before the infection starts.
- (v) Educating students about causes of infectious diseases
- (vi) Proper sanitation or clean environment in school and its surroundings to eradicate vectors of infectious diseases.

Q.4 What is immunisation?

Ans Immunisation is defined as protection of the body from communicable diseases by administration of a particular vaccine to develop immunity against a particular disease.

The vaccine contains weakened form of original pathogens that stimulates the immune system the body.

Q.5 What are the immunisation programs available at the nearest health centre in your locality? Which of these diseases are the major health problems in your area? (to be discussed/marked)

Ans DPT vaccine: it is for diphtheria, whooping cough and tetanus in infants.

Pulse polio vaccine: it is to prevent polio.

BCG vaccine: Bacillus Calmette Guerin vaccine for tuberculosis.

Hepatitis vaccine

TAB vaccine for typhoid.

H1N1 vaccination

Tuberculosis and diarrhoea are the major health problems in our area.

Exercise Questions: Pg. No.187-188

- Q.1 How many times did you fall ill in the last one year? What were the illnesses?**
(a) Think of one change you could make in your habits in order to avoid any of/most of the above illnesses.
(b) Think of one change you would wish for in your surroundings in order to avoid any of/most of the above illnesses. (To be discussed/marked)

Ans I fall ill only once last year. I had suffered from typhoid.

(a) I will avoid street food specially those which are cooked at unhygienic places and kept uncovered.

(b) I shall keep my surroundings cleaner than earlier.

- Q.2 A doctor/nurse/health-worker is exposed to more sick people than others in the community. Find out how she/he avoids getting sick herself/himself.**

A doctor/nurse/health personnel always keep their nose and mouth covered; they wear gloves and cover their bodies with coats, when dealing with sick people. They get immunized to prevent infectious diseases. They also wash hands with soaps thoroughly after serious examination of patients.

- Q.3 Conduct a survey in your neighbourhood to find out what the three most common diseases are. Suggest three steps that could be taken by your local authorities to bring down the incidence of these diseases.**

Ans Three most common diseases in my locality are diarrhoea, malaria and tuberculosis and following steps I would suggest to be taken by our local authorities to bring down the incidence of these diseases:

i.) Supply of safe drinking water and preventing incidences of open drains.

ii) Improved and hygienic environment, free of garbage and wastes thrown in the open.

iii) Eradication of mosquitoes.

iv) Immunisation/vaccination camps

- Q.4 A baby is not able to tell her/his caretakers that she/he is sick. What would help us to find out-**

(a) That the baby is sick?

(b) What is the sickness? (to be discussed/marked)

Ans **(a)** Symptoms that help us to find that baby is sick, are:

(i) continuous crying and restlessness in the child

(ii) improper intake of food and body temperature

(iii) loose motions

(b) Baby is suffering from diarrhoea

- Q.5 Under which of the following conditions is a person most likely to fall sick?**

(a) When she is recovering from malaria.

(b) When she has recovered from malaria and is taking care of someone suffering from chicken-pox.

(c) When she is on a four-day fast after recovering from malaria and is taking care of someone suffering from chicken-pox. Why?

Ans A person is most likely to fall sick when she is on a four-day fast after recovering from malaria and is taking care of someone suffering from chicken-pox because a four day fast will make her body weak due to improper supply of food. Also, malaria is a very fatal disease and it will take some time for the body organs to function normally. Above all, she is taking care of someone who is suffering from most fearful infectious viral disease i.e., chicken pox, she has more chances of getting an infection due to above mentioned reasons.

Q.6 Under which of the following conditions are you most likely to fall sick?

(a) When you are taking examinations.

(b) When you have travelled by bus and train for two days.

(c) When your friend is suffering from measles. Why?

Ans We are most likely to fall sick when a friend is suffering from measles since measles is an infectious/communicable disease that can spread easily from one person to the other.