

## Sample Paper

### General Instructions

- (i) The question paper comprises four sections A, B, C, and D. There are 36 questions in the question paper. All questions are compulsory.
- (ii) (Section-A - question no. 1 to 20 - all questions and parts thereof are of one mark each. These questions contain multiple-choice questions (MCQs), very short answer questions, and assertion - reason type questions. Answers to these should be given in one word or one sentence.
- (iii) Section-B - question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should be in the range of 30 to 50 words.
- (iv) Section-C - question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should be in the range of 50 to 80 words.
- (v) Section-D - question no. - 34 to 36 are long answer type questions carrying 5 marks each. Answers to these questions should be in the range of 80 to 120 words.
- (vi) There is no overall choice. However, internal choices have been provided in some questions. A student must attempt only one of the alternatives in such questions.
- (vii) Wherever necessary, neat, and properly labelled diagrams should be drawn.

### Section A

1. Elements that exhibit properties of both metals and non-metals are known as\_\_\_\_\_.

OR

Name the property:

- (a) Which allows metals to be hammered into thin sheets.
- (b) Which enables metals to be drawn into wires?
- 2. Why is the definition of an atom given by Dalton is no longer valid?
- 3. Which of the following is not the use of isotopes?
  - A. As a fuel in a nuclear reactor
  - B. In the treatment of cancer
  - C. In the treatment of goiter.
  - D. In the treatment of strokes.
- 4. Define uniformly accelerated motion and give one example of it.
- 5. An ant climbs up five stairs, each of width 20 cm and height 20 cm. Find the distance covered and displacement of ant.
- 6. A bird hits the windscreen of a fast-moving car and falls on the bonnet. Which of the two, bird or car, suffer a greater change in momentum?

OR

A body at rest opposes the force which tries to move it. Name this property and give two examples to illustrate it.

- 7. The force of attraction between two, unit point masses separated by a unit distance is called
  - A. gravitational potential
  - B. acceleration due to gravity
  - C. gravitational field
  - D. universal gravitational constant
- 8. When a bullet is fired from a gun, why does the gun recoil?
- 9. What type of energy is possessed by the stretched rubber strings of a catapult?

OR

What type of energy is possessed by the piece of stone which is thrown away on releasing the stretched rubber strings of catapult?

- 10. While doing work and running, you move your organs like hands, legs, etc. Which among the following is correct?
  - A. Smooth muscles contract and pull the ligament to move the bones
  - B. Smooth muscles contract and pull the tendons to move the bones
  - C. Skeletal muscles contract and pull the ligament to move the bones
  - D. Skeletal muscles contract and pull the tendon to move the bones
- 11. Name the plastid which stores starch, oils and protein granules.
- 12. What name is given to the space which fills the space between cells of connective tissue.
- 13. Give one example of: i. Infectious diseases ii. Non-infectious diseases

14. DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of the reason (R).  
Assertion: Calcium and Argon are two examples of Isobars.  
Reason: Isobars are elements with the same mass number but different atomic numbers
- A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of the assertion
  - B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
  - C. Assertion (A) is true but reason (R) is false.
  - D. Assertion (A) is false but reason (R) is true.
15. Assertion: Unlike xylem, phloem can move materials in both the directions.  
Reason: Phloem transfer food
- A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of the assertion
  - B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
  - C. Assertion (A) is true but reason (R) is false.
  - D. Assertion (A) is false but reason (R) is true
16. Assertion: The motion of a body moving in a circular path with constant speed is an example of variable acceleration.  
Reason: Acceleration varies due to change in velocity
- A. both assertion and reason are true and the reason is the correct explanation of the assertion
  - B. both assertion and reason are true but reason is not the correct explanation of the assertion
  - C. assertion is true but reason is false
  - D. assertion is false but reason is true
17. Answer question numbers (a) to (d) on the basis of your understanding of the following paragraph and related studied concepts:  
These days, there is no smallpox anywhere in the world. But as recently as a hundred years ago, smallpox epidemics were not at all uncommon. In such an epidemic, people used to be very afraid of coming near someone suffering from the disease since they were afraid of catching the disease. However, there was one group of people who did not have this fear. These people would provide nursing care for the victims of smallpox.
- (a) Why was smallpox an epidemic earlier and not anymore?
  - (b) Why was it believed that if a person has had smallpox once then he/she will not get it again?
  - (c) What is the basis of immunity?

(d) Name some common diseases against whom vaccines are available?

18. Read the following and answer any **four** questions from 18 (i) to 18 (v)

The composition of two atomic particles is given below:

	X	Y
Protons:	8	8
Neutrons:	8	9
Electrons:	8	8

(i) What is the mass number of X?

(ii) What is the mass number of Y?

(iii) What is the relation between X and Y?

(iv) Which element/elements do they represent?

(v) Give two uses of isotopes.

19. Read the following and answer any **four** questions from 19 (i) to 19 (v)

(i) The continuous zig-zag movement of colloidal particles in a dispersion medium is called \_\_\_\_.

(ii) A pure substance that is made up of only one kind of atom and cannot be broken into two or more simpler substances by physical or chemical means is referred to as \_\_\_\_.

(iii) Which nonmetal is a good conductor of electricity?

(iv) Give one property that describes a compound.

(v) When two liquids do not mix, they form two separate layers and are known as \_\_\_\_.

20. Read the following and answer any **four** questions from 20 (a) to 20 (e)

If you stand without your shoes on gravel (small, irregular stones) or stone chips, your feet hurt. The total force exerted by the gravel is equal to your weight  $W$ . Even if you stand in a nice green lawn, the force exerted by its surface on your feet is the same,  $W$ . But the soft grass of the lawn is much easier on the feet than the gravel. The reason is the difference in area over which this force is distributed. The actual area of contact between your feet and gravel is much smaller than that between your feet and grass. The feeling of discomfort or pain is more directly related to the force per unit area and not so much on the force itself

(a) The force acting on a unit area of a surface is called.

A. Pressure

B. Density

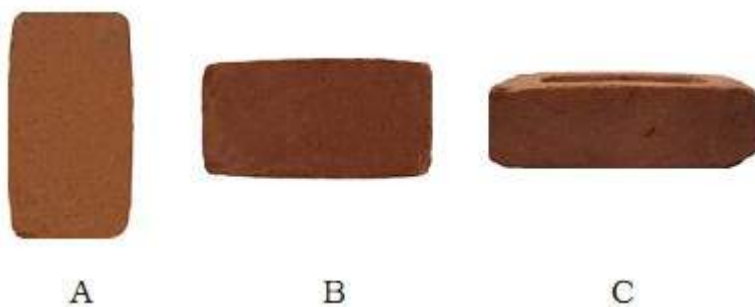
C. Force

D. None of these

(b) What is the SI unit of pressure?

- A.  $\text{N/m}^2$
- B.  $\text{N/kg}^2$
- C.  $\text{N/cm}^2$
- D. None of these

(c) A brick is kept in three different ways on a table as shown in figure below. The pressure exerted by the brick on the table will be



- A. maximum in position A
- B. maximum in position B
- C. maximum in position C
- D. equal in all cases.

(d) A sharp knife enables us to cut through things more easily because

- A. The pressure exerted is lesser for the same force is used
- B. The pressure exerted is greater for the same force is used
- C. The sharp edge can pass through the material slowly
- D. The sharp edge is not felt when cutting through the material.

(e) A cube with a mass of 10kg and sides of length 2m<sup>2</sup> rests on a table. What pressure does this cube exert on the table?

- A. 50 Pa
- B. 25 Pa
- C. 20 Pa
- D. 10 Pa

## Section B

21. Explain how the bark of a tree is formed. How does it act as a protective tissue?

OR

How does an Amoeba obtain its food?

- 22. What will happen if plasma membrane ruptures or breaks down?
- 23. Compute the number of ions present in 5.85 g of sodium chloride

OR

- (a) Identify the heterogeneous mixture from the following:  
Air, soda water, soap solution, brass.
- (b) Write two components of a colloidal solution. Give an example.
24. Write two characteristics of the canal rays.
25. A bus travelled the first one-third distance at the speed of 10 km/h, the next one-third at 20 km/h and the last one-third at 60 km/h. The average speed of the bus is:
26. An object of mass 12 kg is at a certain height above the ground. If the potential energy of the object is 480 J, find the height at which the object is with respect to the ground. Given,  $g = 10 \text{ m s}^{-2}$ .

### Section C

27. Name the tissue responsible for flexibility in plants. How would you differentiate it from other simple permanent tissues?

OR

- (a) Write the location and function of collenchyma tissue.
- (b) Draw a diagram of collenchyma tissue and label any four parts.
28. What is the main cause of increase in  $\text{CO}_2$  in the atmosphere?  
Explain the harmful effect of increase in  $\text{CO}_2$  content in the atmosphere.
29. Explain the mode of action of an antibiotic.
30. (a) Distinguish between mass and weight of a body. When does a body experience weightlessness?  
(b) Does the acceleration produced in a freely falling body depend on the mass of the body?
31. Explain the following giving examples:  
(a) Saturated solution  
(b) Unsaturated solution  
(c) Suspension.
32. (a) How many moles (gram molecules) of  $\text{H}_2\text{SO}_4$  are present in 4.9 g of the acid?  
(a) How many atoms of hydrogen and oxygen are present in 0.15 mole of water ( $\text{H}_2\text{O}$ )?
33. (a) What is the difference between the initial and final momentum of 2 bodies in straight line collision when no external force acts on either?  
(2)  
(b) Give two examples where a body possesses both, kinetic energy as well as potential energy (1)

### Section D

34. (a) What is the general name of the materials which contain at least two pure substances and show the properties of their constituents? (3)  
(b) What is the major difference between a solution and an ordinary mixture? (2)

OR

What is the gold foil experiment? Name the scientist who performed this experiment. Write the conclusions and shortcomings of Rutherford's model of the atom.

35. (a) What is the basis of the Principle of Immunisation?  
(b) Why do most children in many parts of India are already immune to Hepatitis-A though they have never been vaccinated against it?  
(c) Name two diseases caused by each of the following: (i) Bacteria  
(ii) Virus (iii) Fungi
36. (a) Can a body have mass but no weight? Give reasons for your answer.  
(b) Is the acceleration due to gravity of earth 'g' a constant? Discuss  
(c) A stone resting on the ground has a gravitational force of 20 N acting on it. What is the weight of the stone? What is its mass? ( $g = 10 \text{ m/s}^2$ )

\*\*\*

## Hints & Solutions

### Section A

1. **Solution:**

Some elements have intermediate properties of metals and non-metals. The elements which exhibit the properties of metals as well as non-metals, are called metalloids. Example: Boron, Silicon, Germanium, etc

OR

**Solution:**

(a) Malleability is the property that allows metals to be hammered into thin sheets. For example- Aluminium

(b) Ductility is the property that allows metals to be drawn into wires. For example – Copper

2. **Solution:** Atoms contain protons, neutrons, and electrons. Dalton was not able to explain this concept. According to him, atoms are indivisible particles. Hence, the definition of an atom given by Dalton is no longer valid.

3. **Solution:** Isotopes are variants of elements having a different number of neutrons. These find many uses in the medical field where they are used to treat cancer, goiter, etc. Strokes are not treated by isotopes.

4. **Solution:** Uniformly Accelerated motion: When a body moves along a straight line and its velocity increases by equal amounts in equal intervals of time then the motion is called uniformly accelerated motion.

For example, a freely falling body

5. **Solution:**

$$\text{Height} = 20\text{cm}$$

$$\text{Width} = 20\text{cm}$$

$$\text{Distance to climb 1 stair} = 20 + 20 = 40\text{cm}$$

$$\text{Distance to climb 5 stairs} = AB + BC$$

$$= 5 * 40$$

$$= 200\text{cm}$$

$$\text{Displacement} = \sqrt{AB^2 + BC^2} = 100\sqrt{2}$$

6. **Solution:** The momentum is given by ,  $p = m \times v$  , that is product of mass and velocity. As we know that mass of both the objects will be constant and what will change is velocity , so car due to heavier mass and hence more inertia of motion will remain in motion and will



experience little reduction in speed whereas bird has negligible mass as compared to car , so it will experience more drastic change in it's velocity and in momentum.

OR

This is an inherent property called inertia of rest which is directly proportional to the mass of the object.

Examples: –

1. When we beat carpet dust particles comes out.
2. When you shake the branch of tree fruits or leaves comes out.

7. **Answer:** D

**Solution:**

According to universal law of gravitation

$$F = G \frac{m_1 m_2}{r^2}$$

Here point masses are separated by unit distance

Hence  $m_1$ ,  $m_2$  and  $r = 1$

Hence  $F = G$  which is a universal constant hence answer is universal gravitational constant

8. **Solution:** The gun recoils to conserve momentum before and after the gun fires.
9. **Solution:** The stretched rubber band possesses potential energy by virtue of change in shape

OR

The stone possesses kinetic energy as it is in motion.

10. While doing work and running, you move your organs like hands, legs, etc. Which among the following is correct?
  - A. Smooth muscles contract and pull the ligament to move the bones
  - B. Smooth muscles contract and pull the tendons to move the bones
  - C. Skeletal muscles contract and pull the ligament to move the bones
  - D. Skeletal muscles contract and pull the tendon to move the bones

**Answer:** D

**Solution:**

Skeletal muscles contract and pull the tendon to move the bones

11. **Solution:** Leucoplast is a type of plastid which stores starch, oil and protein granules
12. **Solution:** Matrix is the name given to the space which fills the space between cells of connective tissue.

13. **Solution:** i. Malaria ii. Heart-attack

14. **Answer:** A

15. **Answer:** B

**Solution:** Phloem transfer food in both the directions since it is made up of living cells they are able to use energy to push the food in any direction, as per the requirement of the plant.

16. **Answer:** D

**Solution:** A body undergoing circular motion is in accelerated motion. The speed of the body remains the same but its direction changes continuously. If the velocity of a moving body changes when either of the two; direction or the magnitude of the body changes.

17. **Solution:**

- (a) We have been able to eradicate it completely by immunization.
- (b) This was believed to be so because it was seen that if a person gets a disease once, the body remembers the infection and fights against it with increased vigour the next time.
- (c) The basis of the principle of immunization is that our body develops memory for a particular disease by putting the infection in a small dose into the body so that subsequent exposure will not develop into actual diseases.
- (d) Vaccines are available for – Tetanus, diphtheria, whooping cough, measles, polio etc.

18. **(a)Solution:**

(i) Using the general formula:

The mass number of an atom = Number of Neutrons + Number of Protons

The mass number of X is  $(8+8) = 16$ .

(ii) What is the mass number of Y?

**(b)Solution:**

(ii) The mass number of Y is  $(8+9) = 17$ .

(iii) What is the relation between X and Y?

**(c)Solution:**

(iii) The relation between X and Y is, both are isotopes.

(iv) Which element/elements do they represent?

**(d) Solution:**

(iv) Both the element X and Y represent oxygen.

(v) Give two uses of isotopes.

**(e) Solution:**

- 1. In medicine, isotopes are used in photosynthesis to study the effect of animal metabolism on food.
- 2. Isotopes are used in the sensors of smoke detectors in buildings.

19. 19. (i)

**Solution:**

Brownian movement

19. (ii)

**Solution:**

an element

19. (iii)

**Solution:**

Graphite

19. (iv)

**Solution:**

(a) It is composed of two or more elements.

(b) It is a pure substance.

(c) It cannot be separated into constituents by physical means.

19. (v)

**Solution:**

Immiscible liquids

20. 20(a)

**Answer:** A

**Solution:**

Pressure is defined as the force per unit area

20(b)

**Answer:** A

**Solution:**

The SI unit of pressure by definition is  $\text{N/m}^2$

20(c)

**Answer:** A

**Solution:**

The smaller the area, larger is the pressure on a surface for the same amount of force (the weight of the brick). Hence, the brick A whose area of contact is minimum will exert more pressure on the table.

Thus, option A is the correct answer.

20(d)

**Answer:** B

**Solution:**

Greater amount of pressure is exerted on an object if the surface area in contact is lesser for the same amount of force

Mathematically, pressure is described as

$$Pressure = \frac{Force}{Area}$$

If the area is reduced for a fixed amount of force, the magnitude of the pressure increases. Thus, option B is the correct answer.

20(e)

**Answer:** B

**Solution:**

The pressure due to a certain force  $F$  on a surface of area  $A$ , is given as

$$P = \frac{F}{A}$$
$$P = \frac{100}{4} = 25$$

Since pressure is a scalar quantity, only the magnitude of force is required to calculate pressure.

## Section B

21. **Solution** - A strip of secondary meristem replaces the epidermis of the stem. Cells on the outside are cut off from this layer. This forms the several-layer thick cork or the bark of the tree. Cells of cork are dead and compactly arranged without intercellular spaces and have a chemical called suberin in their walls which makes them impervious to gases and water

OR

**Solution** - Amoeba obtains food using temporary finger-like extensions on the cell surface which fuse over the food particle forming a food-vacuole. Complex substances are broken down into simpler ones inside the food vacuole which then diffuse into the cytoplasm. The remaining

undigested material is moved to the surface of the cell and thrown out resulting in excretion.

22. **Solution** - Plasma membrane is a selectively permeable membrane of the cell that maintains homeostasis, i.e. a constant internal composition of the cell. If it ruptures or breaks down, the constant internal composition of the cell will be lost and the cell will not be able to perform its basic functions. Such a cell with a ruptured plasma membrane gets killed.

23. **Solution:** Moles of NaCl present in 5.85 g =  $5.85\text{g} / 58.5\text{ g/mol} = 0.1$  moles Or 0.1 moles of NaCl molecules.

Each NaCl molecule has 2 ions, one Na<sup>+</sup> cation and one Cl<sup>-</sup> anion.

Hence total moles of ions =  $0.1 \times 2 = 0.2$  moles

Number of ions =  $0.2 \times 6.022 \times 10^{23}$

$$= 1.2042 \times 10^{23} \text{ ions}$$

OR

(a) Identify the heterogeneous mixture from the following :

Air, soda water, soap solution, brass.

(b) Write two components of a colloidal solution. Give an example.

**Solution:** (a) Soap solution is a heterogeneous mixture while the rest are of homogeneous nature.

(b) The two components of a colloidal solution are the dispersed phase and the dispersion medium. For example, a colloidal solution of starch in water (Starch acts as a dispersed phase and water as the dispersion medium).

24. **Solution:**

- The canal rays are deflected by the magnetic fields in a direction opposite to that of the cathode rays.

- They consist of positively charged particles.

25. **Solution:** Let the total distance =  $3d$ , the time taken for first one-third journey =  $d/10$ , then for the next one third journey, the time taken is =  $d/20$ , and for the last one third journey the time taken is  $d/60$ .

Therefore, total time of the journey is

$$= \frac{d}{10} + \frac{d}{20} + \frac{d}{60} = \frac{10d}{60} = \frac{d}{6}$$

*Then average speed*

$$\frac{\text{Total distance}}{\text{Total Time}} = \frac{3d}{\frac{d}{6}} \times 6 = 18 \text{ km/hr}$$

26. **Solution:** In the question, the object possesses potential energy by virtue of its height. To obtain the height, the expression of potential energy must be equal to the given value of potential energy.  
Mass of the object,  $m = 12 \text{ kg}$ , potential energy,  $P.E. = 480 \text{ J}$ .

$$P.E. = mgh$$

$$480 = 12 \times 10 \times h$$

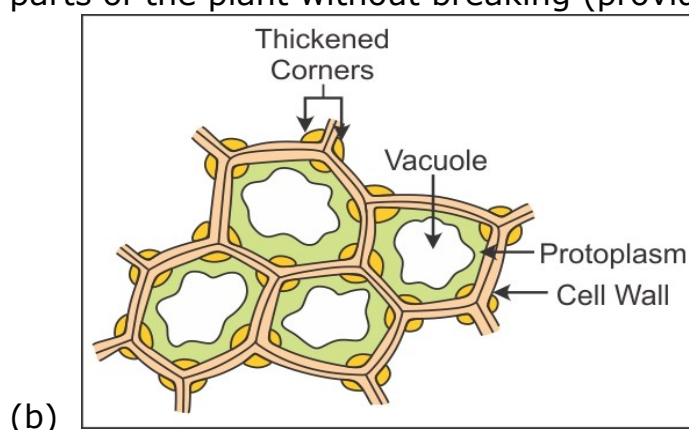
$$h = 4 \text{ m}$$

### Section C

27. **Solution** - Collenchyma is responsible for flexibility in plants. Difference between collenchyma and other permanent tissues: Parenchyma Collenchyma Sclerenchyma It consists of relatively unspecialised cells with thin walls. The cells of this tissue are living. The cells of this tissue are living, elongated and irregularly thickened at the corners. The cells of this tissue are dead. They are long and narrow as the walls are thickened due to lignin. The cells in this tissue contain large intercellular spaces. The cells in this tissue have very little intercellular space. The walls of cells are so thick that there is no internal space inside the cell and between the cells. It provides support to plants and also stores food. It allows easy bending in various parts of a plant (leaf, stem) without breaking. It also provides mechanical support to plants. It provides strength to the plant parts.

OR

**Solution** - (a) Collenchyma tissue Location: In the leaf stalk and below the epidermis. Function: It allows easy bending in various parts of the plant without breaking (provides flexibility in plants).



28. **Solution** - Industrial revolution is the main cause of increase in carbon dioxide in the atmosphere. Increase in carbon dioxide gives rise to global warming which causes imbalance in nature, affects monsoons and rainfall.

29. **Solution** - Antibacterial action generally falls within one of four mechanisms, three of which involve the inhibition or regulation of enzymes involved in cell wall biosynthesis, nucleic acid metabolism and repair, or protein synthesis, respectively. The fourth mechanism involves the disruption of membrane structure. Many of these cellular functions targeted by antibiotics are most active in multiplying cells. Since there is often overlap in these functions between prokaryotic bacterial cells and eukaryotic mammalian cells, it is not surprising that some antibiotics have also been found to be useful as anticancer agents.

30. **Solution:**

(a) The mass of a body is a measure of its inertia. It is independent of the acceleration due to gravity at a place. The weight of a body is the force with which it is attracted to the earth. It is directly proportional to the acceleration due to gravity. Thus, we feel heavier on earth than the moon. We experience weightlessness during free fall because we have no support to feel our weight

(b) The acceleration of a freely falling body is equal to  $g$ , which is known as acceleration due to gravity

The expression for acceleration due to gravity is

$$g = \frac{GM}{R^2}$$

$G$  is universal gravitational constant,

' $M$ ' is mass of the earth,

And ' $R$ ' is radius of the Earth

From the above expression, it is clear that the acceleration of a freely falling body doesn't depend on mass of the body, but depends on mass of the planet

31. .

**Solution** : (a) A solution in which at a given temperature, no more solute can be dissolved by the solvent is called a saturated solution. The concentration of such solutions is the maximum at a given temperature.

To illustrate this, take a glass or a beaker and add some common salt to it. Fill the beaker with water and stir it well. One now gets a salt solution. Continue adding salt slowly to the beaker along with stirring. At some point in time, the solution reaches a state where even though salt is added and stirred, some of the salt stays undissolved. Then one

can say that the solution has reached its saturation level at that temperature.

(b) A solution in which at a given temperature, more solute can be dissolved by the solvent is called an unsaturated solution. Unsaturated solutions can be made saturated by adding more solute to it. In the activity mentioned in (a), the solution obtained in the beginning is an unsaturated solution.

(c) The suspension is a heterogeneous mixture of two or more components. The particles forming the suspension are visible to the naked eye. In this mixture, the solute particles do not dissolve in the solvent, instead, they remain suspended in the solvent medium. When left undisturbed, the solute particles tend to settle down at the bottom of the container.

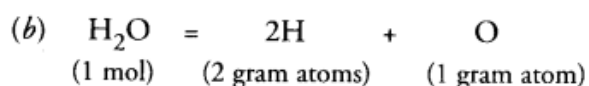
Eg: Mixture of sand and water forms a suspension.

### 32. Solution:

(a) Gram molecular mass of  $\text{H}_2\text{SO}_4 = 2 \times 1 + 32 + 4 \times 16 = 98 \text{ g}$

98 g of  $\text{H}_2\text{SO}_4 = 1 \text{ gram molecule}$

$$4.9 \text{ g of } \text{H}_2\text{SO}_4 = \frac{4.9}{98} = 0.05 \text{ gram molecule}$$



1 mole of water ( $\text{H}_2\text{O}$ ) has H atoms = 2 grams

$$\begin{aligned} 0.15 \text{ mole of water } (\text{H}_2\text{O}) \text{ has H atoms} &= (2 \times 0.15) = 0.30 \text{ gram} \\ &= 0.30 \times 6.022 \times 10^{23} \text{ atoms} \\ &= 1.81 \times 10^{23} \text{ atoms} \end{aligned}$$

1 mole of water ( $\text{H}_2\text{O}$ ) has O atoms = 1 gram atoms

$$\begin{aligned} 0.15 \text{ mole of water } (\text{H}_2\text{O}) \text{ has O atoms} &= 0.15 \text{ gram atoms} \\ &= 0.15 \times 6.022 \times 10^{23} = 9.03 \times 10^{22} \text{ atoms} \end{aligned}$$

### 33. Solution:

(a) When no external force acts on either body involved in a straight-line collision then law of conservation of momentum holds true.

According to the law, momentum before and after collision is conserved so their difference will be zero.

(b) (i) A flying airplane has kinetic energy as well as potential energy.



(As it is on a certain height and moving)

(ii) A man climbing a hill has kinetic energy as well as potential energy

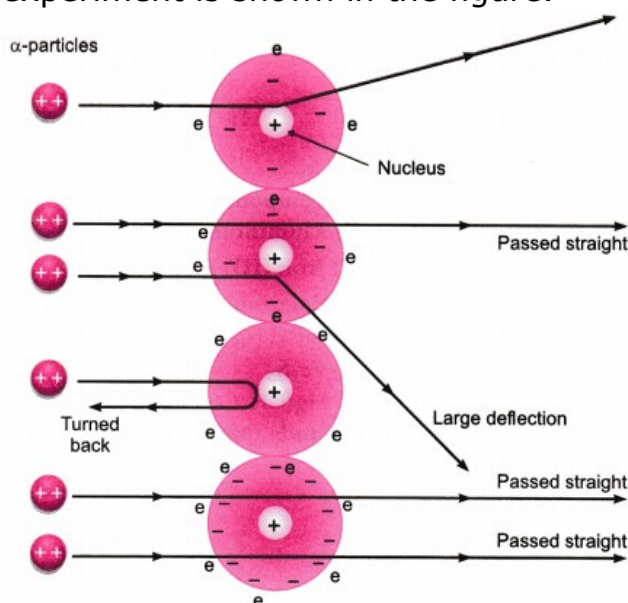
(As it posses both height and velocity)

## Section D

34. **Solution:** (a) Substances that are made of two or more materials and which can be separated by physical methods are known as mixtures, such as the mixture of salt and water, the mixture of sugar and water, the mixture of different gases, air, etc. In a mixture, components do not combine chemically or through any chemical change. In a mixture, components do not lose their properties.
- (b) Mixture of two or more substances with one phase only, i.e. having no distinct boundary of constituent particles is called a solution. For example, solution of sugar and water, solution of salt and water, lemonade, soft drinks, etc. The solution is a homogeneous mixture of two or more substances; an ordinary mixture is made up of two or more matters and which can be separated by physical methods, such as the mixture of different gases, air. In a mixture, components do not combine chemically or through any chemical change.

OR

**Solution:** In 1911, Rutherford performed the gold foil experiment. He bombarded a stream of  $\alpha$ -particles on a gold foil, a thin sheet which was 0.00006 cm thick in an evacuated chamber. An alpha-particle is a positively charged helium ion ( $\text{He}^{2+}$ ). A simplified picture of this experiment is shown in the figure.

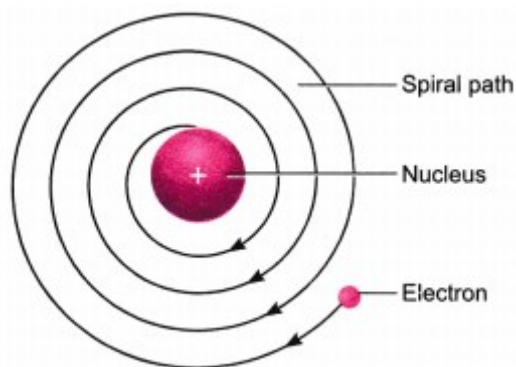


In this famous experiment, the following observations were made.

- Most of the  $\alpha$ -particles passed straight through the foil without any deflection. This concluded that most of the space inside of an atom is empty.
- A few  $\alpha$ -particles were deflected through small angles and a few through larger angles. This happened due to the positive charge on alpha-particles and core (nucleus) of the atom. The heavy positively charged 'core' was named as the nucleus.
- The number of  $\alpha$ -particles that bounced back was very small. This concluded that the volume of the nucleus is very small in comparison to the total volume of the atom.

On the basis of the gold foil experiment, Rutherford concluded that an atom consists of the nucleus which has a positive charge and it is surrounded by electrons that are moving around the nucleus. The number of electrons and protons are equal and the entire mass of the atom is concentrated at its nucleus.

Drawbacks in the Rutherford's model are:



- According to classical electromagnetic theory, a moving charged particle, such as an electron under the influence of attractive force loses energy continuously in the form of radiations. As a result of this, the electron should lose energy and therefore, should move in even smaller orbits ultimately falling into the nucleus. But the collapse does not occur. There is no explanation for this behaviour

35. **Solution** - (a) Immune system develops a memory for a particular infection when it encounters it for the first time. So, when the next time that particular microbe enters the body, the immune system responds against it with even greater vigour.  
(b) Because they are already exposed to the Hepatitis A virus through contaminated water.  
(c) (i) Bacterial diseases - cholera and tuberculosis. (ii) Viral diseases - common cold and influenza. (iii) Fungal diseases - Food poisoning and skin infections.
36. **Solution:** (a) Yes, weight of a body is not constant, it varies with the value of acceleration due to gravity,  $g$ . Weight of a body is zero, when

it is taken to the centre of the earth or in the interplanetary space, where  $g=0$

(b) No, the value of acceleration due to gravity ( $g$ ) is not constant at all the places on the surface of the earth. Since the radius of the earth is minimum at the poles and maximum at the equator, the value of  $g$  is maximum at the poles and minimum at the equator. As we go up from the surface of the earth, the distance from the centre of the earth increases and hence the value of  $g$  decreases. The value of  $g$  also decreases as we go down inside the earth.

(c) Weight of the stone = Gravitational force acting on it = 20 N

$$\text{Weight, } W = m \times g$$

$$20 = m \times 10$$

$$m = 2 \text{ kg}$$

\*\*\*