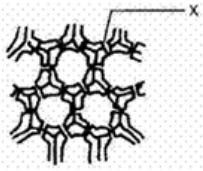
Class IX Session 2025-26
Subject - Science
Sample Question Paper - 9

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This question paper consists of 39 questions in 3 sections. Section A is Biology, Section B is Chemistry and Section C is Physics.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.

Section A

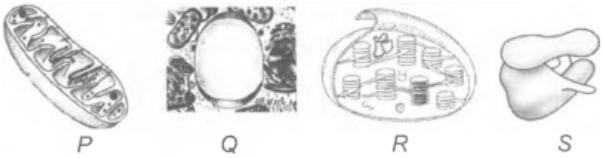
1. 

[1]

The part marked 'X' in the diagram is

a) simple pit pair
b) vacuole
c) intercellular space
d) narrow lumen

2. Among the following cell organelles P, Q, R and S, which is the odd one out? **[1]**



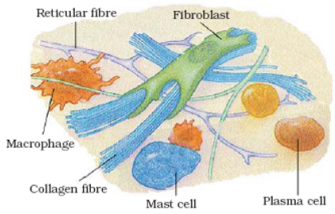
a) P, because the others are involved in cell secretion.
b) R, because the others are involved in protein storage.
c) S, because the others are membrane bound cell organelles.
d) Q, because the others are involved in energy production.

3. Match the following with the correct response given below**:** **[1]**

(1) Largest cell	(A) Mycoplasma
(2) Smallest cell	(B) Bacteria
(3) Single cell	(C) Amoeba
(4) Prokaryotic cell	(D) Ostrich egg

a) 1-C, 2-B, 3-D, 4-A
b) 1-D, 2-A, 3-C, 4-B
c) 1-B, 2-D, 3-A, 4-C
d) 1-A, 2-C, 3-B, 4-D

4. Identify a connective tissue found around blood vessels and nerves and in the bone marrow. **[1]**



a) Cartilage
b) Ligaments
c) Adipose tissues
d) Areolar tissues

5. Preventive and control measures adopted for the storage of grains include **[1]**

a) strict cleaning
b) all of these
c) proper drying
d) fumigation

6. **Assertion (A):** The root tips of a plant were cut and the plant was replanted. The plant will die within few days of replanting. **[1]**

Reason (R): The root tips are cut, the roots won't grow because of the absence of meristematic tissue. And if the roots will not grow, proper absorption of water and minerals will not occur.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

7. **Assertion (A):** The grains should be washed before storage. **[1]**

Reason (R): They should be filled in new gunny bags before keeping in godowns, warehouses, or stores.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

8. How are messages conveyed from one place to another within the body? **[2]**

9. What are the characteristics features of ideal shelters for cattle? **[2]**

OR

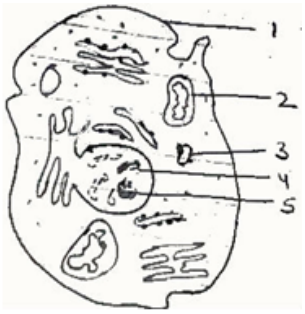
What do you mean by hypophysation? What are its advantages?

10. What is pasturage? Why it is important? **[2]**

11. Observe the given below image of the tissue and answer the following questions: **[3]**

i. Identify the type of tissue shown in the given image.
ii. Where is it found?
iii. Why this tissue acts as an insulator?

12. Observe the diagram of the cell below - answer the following questions. **[3]**



i. Label the parts of the cell

ii. what function does part 1 perform?

iii. If the organelle 2 is removed from the cell, what effect is it going to make on the functions of the cell?

iv. Identify, whether it is plant cell or animal cell

v. Which structure is called 'Powerhouse of the cells'?

13. **Read the following text carefully and answer the questions that follow:** **[4]**

The animal body are covered by epithelial tissue. The epithelial tissue cover most of the organ and cavity with in the body. It also form barrier to keep different body systems separate. The skin, the lining of the mouth, lining of the blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue. The oesophagus and lining of mouth are covered with squamous epithelium. Skin help in protecting the body. The columnar cell have hair-like projection called cilia. Cuboidal epithelium form lining of the kidney tubules and duct of salivary gland.

i. What type of cell are present where absorption and secretion occur? (1)

ii. Skin helps in the protection of body explain? (1)

iii. How cilia clear mucus? (2)

OR

What is glandular epithelium? (2)

14. What is membrane biogenesis? How is plasma membrane formed during this process? **[5]**

OR

i. Describe adipose tissue with the help of diagram.

ii. How is adipose tissue different from blood tissue?

Section B

15. Identify the incorrect statement. **[1]**

a) Acetone is the least volatile liquid.
b) Water is the least volatile liquid.
c) Ether is a volatile liquid.
d) Alcohol is moderately volatile.

16. Which of the following statement is incorrect **[1]**

A. The properties of a compound are different from its constituents elements

B. A mixture is homogenous but a compound is heterogeneous

C. Formation of a compound is a chemical change

D. Formation of a mixture is a chemical change

a) B and D
b) C and D
c) (A), (B), (C) and (D)
d) A, B and D

17. Which type of solution is formed when sand and water are mixed thoroughly and then kept undisturbed for some time? **[1]**

a) Suspension
b) Mixture

c) True solution d) Colloidal

18. Match the following with the correct response : **[1]**

(1) Canal rays consist of positively charged particles protons	(A) Rutherford
(2) Electrons are distributed in shells	(B) J.J.Thomson
(3) Centre of an atom is dense	(C) J.Dalton
(4) Atom is indivisible	(D) Neils Bohr

a) 1-B, 2-D, 3-A, 4-C b) 1-C, 2-B, 3-D, 4-A

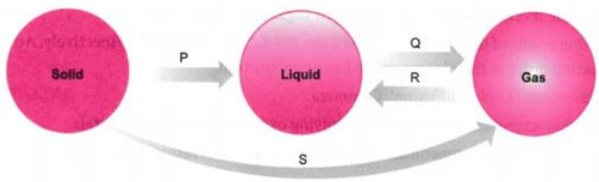
c) 1-D, 2-A, 3-C, 4-B d) 1-A, 2-C, 3-B, 4-D

19. Sulphate of a divalent metal M exists in hydrated form. If 0.10 mol of metal sulphate combines with 9.0 g of water to form the hydrated salt then, the formula of metal sulphate will be **[1]**

a) $M_2SO_4 \cdot 2H_2O$ b) $MSO_4.5H_2O$

c) $M_2SO_4 \cdot 3H_2O$ d) $MSO_4 \cdot H_2O$

20. Which of the changes is/are endothermic? **[1]**



a) S b) P, S

c) P,Q,S d) R

21. A mixture of sulphur and carbon disulphide is **[1]**

a) homogeneous and shows Tyndall effect b) homogeneous and does not show Tyndall effect

c) heterogeneous and shows Tyndall effect d) heterogeneous and does not show Tyndall effect

22. **Assertion (A):** Pure water obtained from different sources such as a river, well, spring, sea, etc. always contains hydrogen and oxygen combined in the ratio of 1: 8 by mass. **[1]**

Reason (R): A chemical compound always contains the same elements combined in the same fixed proportion by mass.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

23. What are ionic and molecular compounds? Give examples. **[2]**

24. Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why. **[3]**

OR

Differentiate between physical and chemical change?

25. What do you think would be the observation if the α-particle scattering experiment is carried out using a foil of **[3]**

a metal other than gold?

26. **Read the following text carefully and answer the questions that follow:** **[4]**

Homogeneous mixtures are regarded as solutions or true solutions. Heterogeneous mixtures are of two types. These are suspensions and colloidal solutions. These differ in the size of the particles responsible for the difference in their properties. In a suspension, the particle size is more than 10^{-5} cm whereas in a colloidal solution, it ranges between 10^{-5} cm to 10^{-7} cm. The two phases which constitute colloidal solutions, are dispersed phase and dispersion medium. Based upon their nature, the colloidal solutions are classified into eight types. The mixture of the non-reacting gases is always homogeneous irrespective of their nature. Therefore, it is not a colloidal solution.

i. Scattering of light occurs when a beam of light is passed through Blood. Why? (1)
ii. What is Tyndall effect? (1)
iii. What is called colloidal solution? (2)

OR

Give an example of colloidal solution and identified their dispersed phase and dispersion medium? (2)

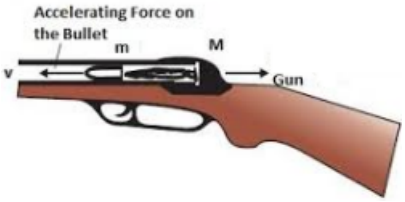
27. What is the gold foil experiment? Name the scientist who performed this experiment. Write the conclusions and shortcomings of Rutherford's model of atom. **[5]**

OR

i. Describe Bohr's model of an atom. Draw a sketch of Bohr's model of an atom with three shells.
ii. What was the drawback of Rutherford's model of an atom?

Section C

28. The image shows the firing of a gun. What happens when a gun is fired? **[1]**



a) Exerts a forward force on the arm
b) Exerts a backward force on the bullet
c) Exerts a forward force on the bullet
d) Exerts a backward force on the arm

29. Statement A: An aeroplane flying at an altitude possesses only K. E. **[1]**
Statement B: An aeroplane flying at an altitude possesses both K. E and P. E.
Which of the two statement is true?

a) statement A
b) statement B
c) neither A nor B
d) both A and B

30. Match the following with correct response. **[1]**

Column A	Column B
(1) v	(A) $\frac{v-u}{t}$
(2) a	(B) $v^2 - u^2$
(3)V_{av}	(C) $\frac{v+u}{2}$
(4) $2aS$	(D) $\frac{s}{t}$

a) 1-C, 2-B, 3-D, 4-A
b) 1-A, 2-C, 3-B, 4-D
c) 1-B, 2-D, 3-A, 4-C
d) 1-D, 2-A, 3-C, 4-B

31. A tank 2 m high is half filled with water and then filled to the top with oil of density 0.60 g/cc. What is the pressure at the bottom of the tank due to these liquids? (Take g = 10 m s^{-2}) **[1]**

a) 1.6×10^4 N m^{-2}
b) 0.8×10^4 N m^{-2}
c) 1.6×10^2 N m^{-2}
d) 0.8×10^2 N m^{-2}

32. **Assertion (A):** The longitudinal waves are called pressure waves. **[1]**
Reason (R): Propagation of longitudinal waves through a medium involves changes in pressure and volume of air, when compression and rarefaction are formed.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

33. A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction force of 5000 N, then calculate: **[2]**

a. the net accelerating force and
b. the acceleration of the train.

34. Two boys A and B weighing 60 kg and 40 kg respectively, climb on a staircase each carrying a load of 20 kg on their head. The staircase has 10 steps, each of height 50 cm. If A takes 20 s to climb and B takes 10 s to climb, then **[2]**

i. who possesses greater power?
ii. find the ratio of their powers.

OR

Five bulbs each having 100 W power are used for 4 h, a heater having 1500 W power is used for 2 h and an electric iron of power 1000 W is used for 5 h.

i. Calculate the total energy consumed by them.
ii. Convert this energy into joules.

35. How does the force of gravitation between two objects change when the distance between them is reduced to half? **[3]**

36. Shyam and his friends were playing with a catapult (gulel) in his garden. Several mangoes were dislodged and fell with the help of catapult. One of his friend was aiming the catapult on a bird. Shyam prevented him from doing so. **[3]**

a. Name the energy possessed by the stretched string of the catapult.
b. What will happen if the stone is thrown without stretching the string of a catapult?
c. Why did Shyam prevent his friend from aiming at the bird? Which quality is highlighted in Shyam's behaviour?

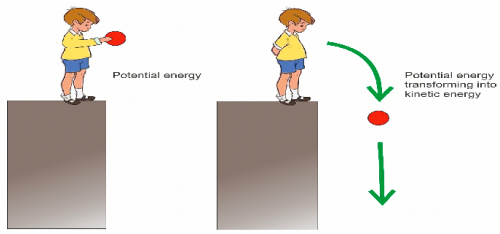
37. A particle moves in a circle with O as centre and AO = OB = 5 cm, radius, as shown in the figure. It starts from A. Calculate. **[3]**

a. the distance covered, and

b. the displacement, when it reaches B.

38. **Read the following text carefully and answer the questions that follow:** **[4]**

Potential energy is stored energy that depends upon the relative position of various parts of a system. Spring has more potential energy when it is compressed or stretched. A steel ball has more potential energy raised above the ground than it has after falling to Earth.



i. If a mass of 10 kg is dropped from a height of 50 cm, then find potential energy just before dropping. (1)

ii. If a mass of 10 kg is dropped from a height of 50 cm, then what is kinetic energy just on touching the ground? (1)

iii. Also, what is the velocity with which it hits the ground? (take, q = 10 ms^{-2}) (2)

OR

Can a body have energy, without having momentum? If yes, why? (2)

39. Give a reason for the following questions: **[5]**

i. It is difficult to balance our body when we accidentally step on a peel of a banana.

ii. Pieces of bursting crackers fall in all possible directions.

iii. A glass pane of a window is shattered when a flying pebble hits it.

iv. It is easier to stop a tennis ball than a cricket ball moving at the same speed.

v. A javelin thrower is marked foul if an athlete crosses over the line marked for the throw. Athletes often fail to stop themselves before the line.

OR

A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the track offers a frictional force of 5000 N, then calculate:

(a) the net accelerating force;

(b) the acceleration of the train; and

(c) the force of wagon 1 on wagon 2.

Solution

Section A

1. **(a)** simple pit pair
Explanation:
The part marked 'X' in the diagram is simple pit pair. In the pair of simple pits of two adjacent cells, each simple pit is more or less uniform-diameter void in the walls. Cell wall contains simple pits. In simple pits the width of the pit chamber is uniform. There is no secondary wall in the simple pit.

2. **(c)** S, because the others are membrane bound cell organelles.
Explanation:
Figures 'P', ‘Q’, ‘R and ‘S’ represent mitochondrion, vacuole, chloroplast and ribosome, respectively

3. **(b)** 1-D, 2-A, 3-C, 4-B
Explanation:
Mycoplasma is a genus of bacteria that lack a cell wall around their cell membrane. Without a cell wall, they are unaffected by many common antibiotics that target cell wall synthesis. **Mycoplasma** species are the smallest free-living organisms. **Prokaryote** is a unicellular organism that lacks a membrane-bound nucleus (karyon), mitochondria, or any other membrane-bound organelle.

(1) Largest cell	(D) Ostrich egg
(2) Smallest cell	(A) Mycoplasma
(3) Single cell	(C) Amoeba
(4) Prokaryotic cell	(B) Bacteria

4. **(d)** Areolar tissues
Explanation:
Areolar connective tissue is the simplest and most widely distributed connective tissue. It is found between the skin and muscles, around blood vessels and nerves, and in the bone marrow.

5. **(b)** all of these
Explanation:
Preventive and control measures adopted for the storage of grains include strict cleaning of the produce before storage, proper drying of the product first in sunlight and then in a shade, and fumigation using chemicals that can kill pests.

6. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
The plant will die within few days of replanting. This is because since the root tips are cut, the roots won’t grow because of the absence of meristematic tissue. And if the roots will not grow, proper absorption of water and minerals will not occur.

7. **(d)** A is false but R is true.
Explanation:
The grains should be cleaned before storage. They should be filled in new gunny bags before keeping in godowns, warehouses, or stores.

8. Messages are conveyed from one place to another within the body through the nervous tissue. A **nervous tissue** is made up of **neurons** that receive and conduct impulses. Neurons are highly specialised for stimulation and rapid transmission of the stimulus from one place to another within the body. Impulses are the passage of electrical activity along the axon of a nerve cell.
9. Characteristics of of an ideal shelter are –
   1) The shed should be properly roofed to protect the animals from rain, heat and cold.
   2) The floor of the shed is made sloping to facilitate cleaning and keep their sitting space dry.
   3) Arrangement for clean drinking water is made.
   4) The sheds have proper arrangement for disposal of excreta and should be well ventilated.

OR

Hypophysation includes the extraction of hormones from the pituitary glands of donor fishes and injecting the same to Carps in captivity, i.e., either in hatchery or ponds.

Advantages:

i. Carps breed in rivers and not in captivity. By hypophysation, Carps can be made to breed in captivity.
ii. We get healthy and pure seeds for fish farming, which ensures the supply of the same in desired quantity.

10. Flower available for the collection of nectar and pollen from the bees is known as pasturage or flora. It is important for apiculture ie.
    (i) Quality of honey and taste of honey depends upon pasturage.
    (ii) Rearing of honey bee for bee wax and honey production.
11. i. The given image shows adipose connective tissue.
    ii. Adipose connective tissue is found below the skin and between internal organs.
    iii. The cells of adipose connective tissue are filled with fat globules. So the storage of fats let it act as an insulator.
12. a. 1. Cell membrane
    2. Mitochondrion
    3. RER
    4. Chromosome
    5. Nucleolus

    b. Selective transport of substances.
    c. Cell becomes energy deficient
    d. Animal cell (cell wall absent)
    e. Mitochondria
13. i. Tall epithelial cell.
    ii. Skin epithelial cell are arranged in many layer to prevent wear and tear.
    iii. Cilia can move and their movement pushes the mucus forward to clear it.

OR

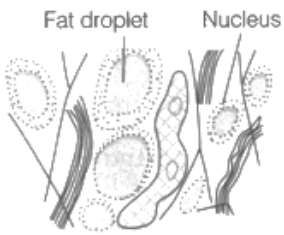
The multicellular gland formed due to the inward folding of a portion of epithelial tissue is called the glandular epithelium.

14.

The process of plasma membrane formation is called membrane biogenesis. Following organelles are involved in this process: The proteins and lipids are first synthesized in the rough endoplasmic reticulum and the smooth endoplasmic reticulum, respectively. These are then transported to the Golgi complex for their modification. After modification, these are transported to the cell surface through vesicles which bud off from the Golgi complex to fuse with the cell membrane and form a part of the membrane.

OR

i. Digrammatic representation of Adipose tissue



Adipose tissue is a fat-storing connective tissue. Its matrix is packed with large oval fat cells or adipocytes. The fat cells are

arranged into globules separated by collagen and elastic fibres. It mainly stores reserve fat. It acts as an insulator and works as a shock absorber for visceral organs. It acts as shock-absorbing cushions around the heart, kidneys, eyeball, etc.

ii. Differences between adipose and blood tissue are as follows:

Adipose Tissue	Blood Tissue
1. Adipose tissue is a type of loose connective tissue located mainly beneath the skin.	1. Blood tissue is a fluid connective tissue containing the plasma, red blood cells (RBCs), white blood cells (WBCs) and platelets.
2. The matrix contains fibres.	2. The matrix does not contain fibres.
3. It stores and metabolises fats.	3. It helps in the transport of substances and respiratory gases.

Section B

15. **(a)** Acetone is the least volatile liquid.

Explanation:

Acetone is the least volatile liquid - is incorrect. Volatile liquids are those liquids that can easily change to their vapour state at a particular temperature. Ether and Acetone are very volatile liquids. Alcohol is moderately volatile and water is the least volatile. Acetone is a solvent that has a variety of important uses and applications.

E.g. It is used in nail polish remover.

16. **(a)** B and D

Explanation:

(A) A compound is a substance formed when two or more elements are chemically bonded together. The property of compound has always different from its constituents. True solution is a homogeneous mixture.

(B) Compound has a fixed composition. Mixture has a variable composition. So, compound is homogenous and mixture is heterogeneous.

(C) A compound is a substance formed when two or more elements are chemically bonded together. So, formation of a compound is a chemical change.

(D) Constituents of mixture can be separated by physical methods. So, Formation of a mixture is a physical change.

So, statement (B) and (D) are incorrect statement.

17. **(a)** Suspension

Explanation:

Sand will form a suspension in water. If you shake a container of sand and water, the sand spreads through the water, forming a cloudy liquid. The sand will then settle to the bottom of the container as sediment. Suspensions often need to be shaken or stirred before use to spread the sediment through the liquid.

18. **(a)** 1-B, 2-D, 3-A, 4-C

Explanation:

(1) Canal rays consist of positively charged particles protons	(B) J.J.Thomson
(2) Electrons are distributed in shells	(D) Neils Bohr
(3) Centre of an atom is dense	(A) Rutherford
(4) Atom is indivisible	(C) J.Dalton

19.

(b) $MSO_4.5H_2O$

Explanation:

As the metal is divalent, the formula of hydrated sulphate will be $MSO_4 \cdot xH_2O$

To find the value of x:

0.10 mol of MSO_4 combines with 9 g of H_2O (i.e., 0.5 mol of water).

[$\because$ moles of $H_2O = \frac{9}{18} = 0.5$]

$\therefore$ 1 mol of MSO_4 will combine with $\frac{0.5}{0.10} = 5$ mol of water.

So, formula of sulphate is $MSO_4 \cdot 5H_2O$.

20.

(d) R

Explanation:

The reactions which proceed with the absorption of heat energy are called as endothermic reactions.

21.

(b) homogeneous and does not show Tyndall effect

Explanation:

Sulphur and carbon disulphide do not form a uniform composition and the properties of the mixture are not same throughout. Therefore, it forms a heterogeneous composition.

Moreover, it shows a Tyndall effect, because in water sulphur remains suspended whereas carbon disulphide settles down as a layer at the bottom.

22. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

23. **Ionic compound:** The ionic compounds which are made, up of ions are known as an ionic compound. For example, sodium chloride(NaCl)is an ionic compound which is made up of an equal number of positively charged sodium ions (Na^+) and negatively charged chloride ions (Cl^-).

Molecular compounds are formed by the combination of two different non-metals element. example; H_2 S, CO_2.

24. This is due to a peculiar property of water.The density of water increases by decreasing temperature as all liquids upto 4 degree celcius and attains the maximum density.On further cooling water molecules expand and its density (mass per unit volume) starts decreasing. Thus ice has a lower density than water and it floats on water.

OR

	Physical Changes		Chemical Change
1.	It is not permanent and can easily be reversed.	1.	It is permanent and cannot be easily reversed.
2.	It does not lead to formation of new substances.	2.	It leads to the formation of new substances.
3.	No change in mass is noticed.	3.	There is a change in mass of reactants and products.
4.	The energy changes observed are small.	5.	Large energy changes are observed.

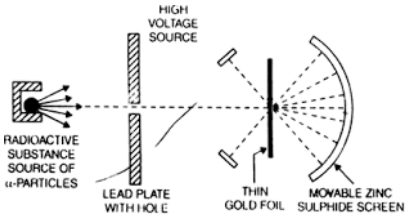
25. The aim of Rutherford's experiment was to test the Thomson's plum-pudding model. Rutherford used a very thin sheet or foil of gold (0.00006 cm in thickness) because gold is the most malleable metal. The α-particles are much smaller than the gold atoms in the foil. If any other metal other than gold had been used in the experiment, there would not have been any difference between the size of the alpha-particles and the metal atoms and therefore there would not have been any penetration of alpha-particles through the foil.

26. i. Since blood is a colloid, so tyndall effect is observed when a beam of light is passed through it since the dispersed particles of a colloid are large, deflect light.
    ii. The phenomenon by which the colloidal particles scatter light is called Tyndall effect. If light is passed through a colloid the light is scattered by the larger colloidal particles and the, beam becomes visible.
    iii. Colloidal solutions area mixture in which the substances are regularly suspended in a fluid. A colloid is a very tiny and small material that is spread out uniformly all through another substance.

    OR

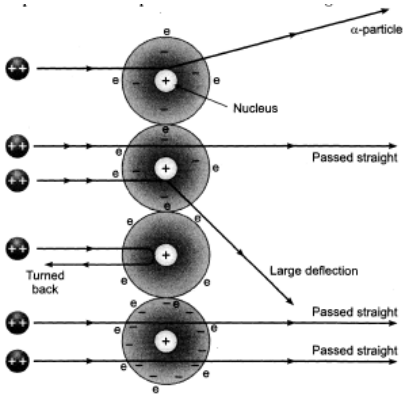
    Fog: Liquid (water drops) acts as dispersed phase and gas (air) as the dispersion medium.

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



Observation:

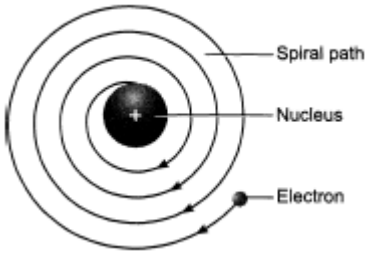
i. Most of the α-particles passed straight through the foil without any deflection.
ii. A few α-particles were deflected through a small angle and few through larger angles.
iii. The number of α-particles which bounced back was very small.



Conclusion:

i. The most of the space inside of an atom is empty.
ii. The heavy positively charged 'core' is present at the centre of atom named as nucleus.
iii. The volume of the nucleus is very small in comparison to the total volume of the atom.

Structure of atom: On the basis of gold foil experiment, Rutherford concluded that an atom consists of nucleus which has positive charge and it is surrounded with electrons which 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. He compared the model of an atom with solar system, in which sun as a nucleus is at center and planets as electrons revolve around the sun.



Drawbacks in the Rutherford's model :

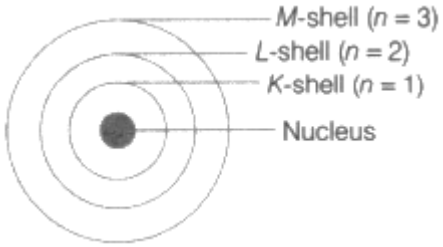
i. According to classical electromagnetic theory, a moving charged particle, such as an electron under the influence of attractive force loses energy continuously in the form of radiations. As a result of this, electron should lose energy and therefore, should move in even smaller orbits ultimately falling into the nucleus. But the collapse does not occur.
ii. Rutherford did not specify the number of orbits and the number of electrons in each orbit.

OR

i. To overcome the objections raised against Rutherford's model of the atom, Neils Bohr put forward the following postulates about the model of an atom:
   a. An atom consists of the positively charged nucleus around which electrons revolve in discrete orbits, i.e. electrons revolve in certainly permissible orbits and not just in any orbit.
   b. Each of these orbits is associated with a certain value of energy. Hence, these orbits are called energy shells or energy levels. As the energy of an orbit is fixed (stationary), the orbit is also called stationary state.
   c. Starting from the nucleus, energy levels (orbits) are represented by numbers (1, 2, 3, 4, etc.) or by alphabets (K, L, M, N, etc.).
   d. The electrons present in the first energy level (E_1) have the lowest energy. Energies increases on moving towards outer energy levels.

e. The energy of an electron remains the same as long as it remains in discrete orbit and it does not radiate energy while revolving.
f. When energy is supplied to an electron, it can go to higher energy levels. While an electron falls to a lower energy level when it radiates energy.

Three shells or orbits are presented by the letters K, Z, M (or the numbers, n = 1, 2, 3)



ii. The drawbacks of Rutherford's model of an atom are:
a. It could not explain the stability of an atom when charged electrons are moving under the attractive force of the positively charged nucleus.
b. Rutherford's model could not explain the distribution of electrons in the extra nuclear portion of the atom.

Section C

28.

(c) Exerts a forward force on the bullet

Explanation:

When a gun is fired, it exerts a forward force on the bullet. The bullet exerts an equal and opposite reaction force on the gun. This results in the recoil of the gun.

29.

(b) statement B

Explanation:

The areoplane has both kinetic energy and potential energy. When it is in flight it will fly above the ground so it is displaced by certain distance and hence it posses potential energy. As it is in motion it posses kinetic energy.

30.

(d) 1-D, 2-A, 3-C, 4-B

Explanation:

i. Velocity of a body is defined as the rate of change of its displacement with time,v = $\frac{s}{t}$
ii. Acceleration of a body is defined as the rate of change of its velocity with time,a = $\frac{v-u}{t}$
iii. Average velocity -If the velocity of a body is always changing,but changing at a uniform rate,then the average velocity is given by the "arithmetic mean" of the initial and final velocity for a given period of time,that is: Average velocity,V_{av} = $\frac{v+u}{2}$
iv. Third equation of motion, $v^2 - u^2 = 2as$

31. **(a)** 1.6×10^4 N m^{-2}

Explanation:

Density of oil (ρ_0) = 0.60 g/cc = 600 kg/m^3

Density of water(ρ_w) = 1 g/cm^3 = 1000 kg/m^3

Pressure due to water =$h\rho_w g$ = $1 \times 1000 \times 10$ = 10000 N m^{-2}

Pressure due to oil = $h\rho_0 g$ = $1 \times 600 \times 10$ = 6000 N m^{-2}

Total pressure = 10000 + 6000 = 16000 N m^{-2} = 1.6×10^4 N m^{-2}

32. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

In longitudinal wave, pressure variations travel along the tube with the density variations, when the density reaches its maximum at a particular location, the pressure also reaches its maximum at that location.

33. a. Net accelerating force is given by

= Force exerted by the engine - Frictional force

= 40000 - 5000 = 35000 N

b. Acceleration is given by

$a = \frac{\text{Accelerating force}}{\text{Mass of train}}$

$= \frac{35000\text{N}}{10000+8000\text{kg}}$ = 1.94 ms^{-2}

34. Given, mass of A (m_A) = 60 kg

mass of B (m_B) = 40 kg

mass of luggage (m_L) = 20 kg

Height of staircase (h) = 0.5 $\times$ 10 = 5 m

So, work done by boy A to climb staircase = mgh = (60 + 20) $\times$ 9.8 $\times$ 5 = 3920 J

So, power of A = $\frac{work}{time} = \frac{3920}{20} = 196\ W$

Similarly, power of Bf = $\frac{work}{time} = \frac{mgh}{t}$

$\frac{[(40+20)\times 9.8\times 5]}{10} = \frac{2940}{10} = 294\ W$

i. B possesses greater power than A.

ii. So, the ratio is given by $\frac{power\ of\ A}{power\ of\ B} = \frac{196}{294}$ = 2:3

So, power, P = $\frac{W}{t} = \frac{3000}{3}$ = 1000 W

OR

i. Energy consumed by five bulbs = $\frac{5\times 100\times 4}{1000}$ = 2 units

Energy consumed by 1 heater = $\frac{1500\times 2}{1000}$ = 3 units

Energy consumed by electric iron = $\frac{1000\times 5}{1000}$ = 5 units

Total energy consumed by them = (2 + 3 + 5) = 10 units

ii. 1 unit or kWh = 3.6 $\times$ 10^6 J

$\therefore$ 10 units = 3.6 $\times$ 10^6 $\times$ 10 J = 3.6 $\times$ 10^7 J

35. According to universal law of gravitation,the gravitational force of attraction between any two objects of mass is proportional to the product of the masses and inversely proportional to the square of the distance between them.Hence if the distance is reduced to half,then the gravitational force becomes four times larger than the previous value.

36. a. Potential energy.

b. If the stone is thrown without stretching the string of catapult the stone will fall down. As the stretched catapult possess potential energy due to stretch. It throws the stone with the high speed as string is released.

c. Shyam prevents his friend form aiming at the bird because stone could harm the bird and he does not want to harm or kill the bird, this shows his care and love for the living beings.

37. a. Distance covered $= \pi \times OA = \pi \times 5 = 5\pi cm$

b. Displacement $= 2 \times OB$

$= 2 \times 5 = 10cm$ along AB

38. i. Given, mass of the object, m = 10 kg

Height, h = 50 cm = 0.5 m

As potential energy is given by PE = mgh

= 10 $\times$ 10 $\times$ 0.5

= 50 J

ii. Given, mass of the object, m = 10 kg

Height, h = 50 cm = 0.5 m

From the law of conservation of energy, the total energy of the ball just before dropping = total energy of the ball just on touching the ground

$\Rightarrow$ KE + PE of the ball just before dropping

$\Rightarrow$ KE = 50 J

iii. Given, mass of the object, m = 10 kg

Height, h = 50 cm = 0.5 m

As we know, KE = 50 J

So, $\frac{1}{2}mv^2 = 50 \Rightarrow v^2 = \frac{50\times2}{10} = 10$

So, the velocity with which it hits the ground,

v = $\sqrt{10}$ = 3.16 ms^{-1}

OR

Given, mass of the object, m = 10 kg

Height, h = 50 cm = 0.5 m

Yes, a body can have energy without possessing momentum. A body may have potential energy and still can be at rest. This means it would have zero momentum and still it could possess energy.

39. i. The reason is that one cannot exert an action force effect on the slippery peel of banana in the backward direction. Hence, in response the ground does not exert sufficient reaction force in forward direction and hence we lose our balance.
    ii. This can be explained on the basis of the law of conservation of momentum. When due to the explosion some pieces move in the same particular direction, then in order to conserve momentum the remaining pieces move in the opposite direction.
    iii. The reason is that the glass pane of the window is a hard solid. The flying pebble suffers a change in momentum in a very short time, so the force exerted by the glass window on the pebble will be large. Consequently, the glass pane of the window will shatter.
    iv. The reason is that the mass of the cricket ball is more than that of a tennis ball. Thus, momentum is more in the case of the cricket ball due to the larger mass as compared to the tennis ball. So, less force has to be applied in the case of the tennis ball to stop.
    v. The reason is that when athletes are running for the throw, then due to the inertia of motion they often fail to stop themselves before the line.

OR

Force exerted by the engine,F' = 40,000 N

Frictional force offered by the track in the direction opposite of the motion,F" = -5,000 N

(a) The net accelerating force, F = F'+F"= 40,000 N + (-5,000 N) = 35,000 N

(b) Mass of each wagon of the train = 2000 kg

Number of wagons = 5

Therefore, Mass of the train,m= 2,000 kg $\times$ 5= 10,000 kg.

Net accelerating force acting on the train,F= 35000 N

From Newton's second law of motion, acceleration

$a = \frac{F}{m} = \frac{35{,}000\ N}{10{,}000\ kg} = 3.5\ ms^{-2}$

(c)Mass of 1 wagon= 2000 kg

acceleration of the train= 3.5 ms^{-2}

From the relation,F =ma,we get

F= 2000 kg $\times$ 3.5 ms^{-2}

F= 7000 N

Force exerted by wagon 1 on wagon 2

=Net accelerating force - Force acting on wagon 1= 35000 N - 7000 N= 28000 N

Therefore,the required answer is 28000 N