Class IX Session 2025-26
Subject - Science
Sample Question Paper - 4

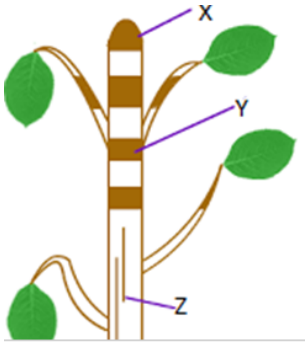
Time Allowed: 3 hours **Maximum Marks: 80**

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. X, Y, and Z are meristematic tissues present at different regions in plants. Which of these are responsible for the increase in girth of stems or roots? **[1]**



a) Y
b) Both Y and Z
c) X
d) Z

2. Cell arises from the pre-existing cell was stated by **[1]**

a) Robert Hook
b) Virchow
c) Purkinje
d) Robert Brown

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

(a) Lysosomes	(i) Smooth endoplasmic reticulum
(b) Centriole	(ii) Spindle formation
(c) Processing & packaging of cell secretions	(iii) Suicidal bags
(d) Synthesis of lipids	(iv) Golgi apparatus

a) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)
b) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)
c) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)
d) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

4. Select the incorrect sentence **[1]**

a) Two bones are connected with ligament
b) Cartilage is a form of connective tissue

c) Blood has matrix containing proteins, salts, and hormones

d) Tendons are non-fibrous tissue and fragile

5. The principal cereal crop in India is _____. **[1]**

a) Wheat

b) Maize

c) Rice

d) Sorghum

6. **Assertion (A):** Most of plant tissues are dead. **[1]**

Reason (R): Due to the sedentary existence of plants, dead cells provide mechanical strength more easily than live ones and need less maintenance.

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):** Cell wall is found in only the animal cells. **[1]**

Reason (R): Cell membrane is found in both plant and animal cells.

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

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

c) A is true and R is false.

d) A is false and R is true.

8. Weeds affect the crop plants by - **[1]**

a) All of these

b) Dominating the plants to grow.

c) Killing of plants in the field before they grow.

d) Competing for various resources of crops (plants)

9. Which of the following is the fastest growing carp? **[1]**

a) Singhara

b) Mrigal

c) Rohu

d) Catla

10. What is the main function of each of the following organelles? **[2]**

(a) Ribosome

(b) Cell wall.

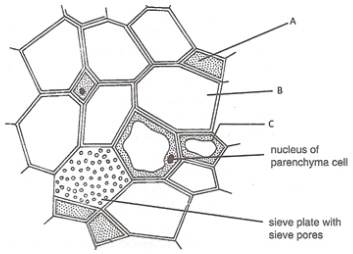
11. Write a short note on xylem. **[2]**

OR

Why is epidermis important for the plants?

12. Define the term hybridization and photoperiod. **[2]**

13. Study the following diagram of phloem and answer the following questions: **[3]**



i. Identify A, B and C in the given diagram.

ii. What term is used for the end walls of the B?

iii. What are the two functions performed by C?

14.  **[3]**

Answer the following questions:

i. Soybean and maize can grow simultaneously on the same field explain?

ii. What is the main purpose of mixed cropping?

iii. Enlist various methods to control weed, insect, and disease.

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

Plant cells, in addition to the plasma membrane, have another rigid outer covering called the cell wall. The cell wall lies outside the plasma membrane. The plant cell wall is mainly composed of cellulose. The nucleus has a double-layered covering called a nuclear membrane. The nuclear membrane has pores that allow the transfer of material from inside the nucleus to its outside, that is, to the cytoplasm. The nucleus contains chromosomes, which are visible as rod-shaped structures only when the cell is about to divide. Chromosomes contain information for the inheritance of characters from parents to the next generation in the form of DNA. The nucleus plays a central role in cellular reproduction, the process by which a single cell divides and forms two new cells.

i. Cellulose is a complex substance which provides? (1)

ii. What are chromosomes made up of? (1)

iii. How is plasmolysis in a plant cell defined? (2)

OR

In which type of solution will the cell shrink? (2)

16. i. State what will happen when human red blood cells are placed in a hypotonic salt/sugar solution. **[5]**

ii. Why plant cell shrinks when kept in a hypertonic solution.

iii. Why lysosomes are known as suicidal bags?

OR

Differentiate between sclerenchyma and parenchyma tissues. Draw a well-labeled diagram.

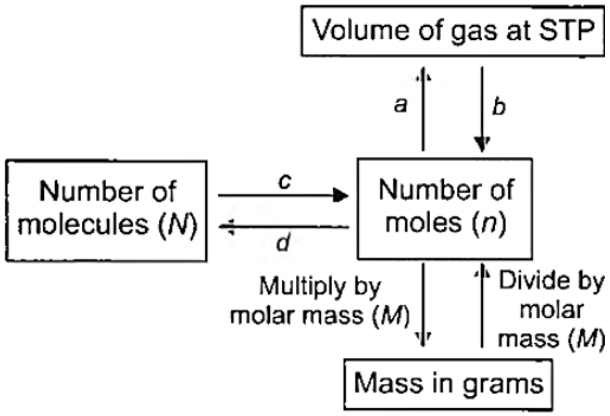
Section B

17. Which of the following solids undergo sublimation upon heating? **[1]**

a) Ice b) Sugar

c) Urea d) Iodine

18. What are a and b? **[1]**



a) a = divide by 22.4 L, b = divide by 22.4 L

b) a = divide by 22.4 L, b - multiply by 22.4 L

c) a = multiply by 22.4 L, b = multiply by 22.4 L

d) a = multiply by 22.4 L, b = divide by 22.4 L

19. **Assertion (A):** When a beam of light is passed through a colloidal solution placed in a dark place the path of the beam becomes visible. **[1]**

Reason (R): Light gets scattered by the colloidal particles.

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.

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

(1) Atomic number	(A) Number of protons
(2) Atomic mass	(B) Same atoms with similar atomic numbers
(3) Isotopes	(C) Total number neutrons and protons
(4) Isobars	(D) Different atoms with similar atomic masses

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

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

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

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

21. Which of the following represents a correct chemical formula? Name it. **[1]**

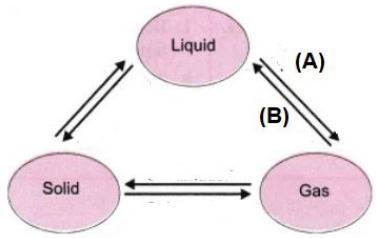
a) NaS

b) $NaSO_4$

c) $BiPO_4$

d) CaCl

22. Following figure shows three states of matter and its interconversion. Which process display in A and B? **[1]**



a) (A)Sublimation (B) condensation

b) (A) Fusion and (B) Condensation

c) (A) Vapourisation (B) Condensation

d) (A) Fusion (B) Solification

23. Tyndall effect is observed in which one of the following? **[1]**

a) Starch + Water

b) NaCl + Water

c) Alum + Water

d) True solution

24. **Assertion (A):** Atomicity of oxygen is 2. **[1]**

Reason (R): 1 mole of an element contains 6.023×10^{23} atoms.

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.

25. You are provided with a fine white coloured powder which is either sugar or salt. How would you identify it without tasting? **[2]**

26. Why do not the dispersed phase particles in a colloidal solution combine with one other? **[3]**

OR

Differentiate between elements and compounds.

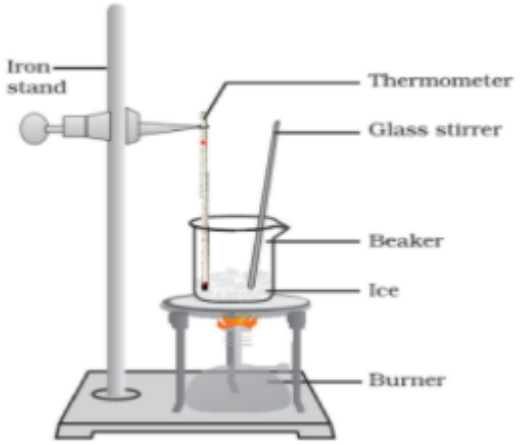
27. An old man and a scientist were talking about a deserted house. The old man was sure that it was haunted by ghosts, but the scientist discarded the view saying no one had ever seen a ghost. The old man was annoyed and challenged the scientist about existence of atoms, sub-atomic particles which also could not be seen. **[3]**

i. Name the three sub-atomic particles and their discoverers.

ii. Whose viewpoint do you support and why?

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

The minimum temperature at which solid melts to become a liquid at the atmospheric pressure is called its melting point. The energy supplied by heat overcomes the forces of attraction between the particles. The particles leave their fixed positions and start moving more freely. A stage is reached when the solid melts and is converted to a liquid. The process of melting, that is, change of solid state into a liquid state is also known as fusion. The temperature of the system does not change after the melting point is reached, till all the ice melts.



i. Define fusion? (1)

ii. What is melting point ? what is the melting point of Ice? (1)

iii. What is latent heat of fusion? (2)

OR

What do you mean by latent heat? (2)

29. i. What is an octet? How do elements attain an octet? **[5]**

ii. Make a schematic atomic structure of magnesium and phosphorus.

[Given number of protons of magnesium =12 and that of phosphorus = 15]

OR

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

Section C

30. As the sailor jumps forward out of a rowing boat, the force on the boat moves it backward. This is an example of **[1]**

a) second law of motion

b) third law of motion

c) law of conservation of momentum

d) first law of motion

31. Two cars A and B approaching each other with a momentum of 50 kg m/s and 25 kg m/s respectively, stick to each other after the collision. The momentum after the collision is: **[1]**

a) 75 kg m/s

b) 50 kg m/s

c) In the direction of B

d) In the direction of A

32. **Assertion (A):** Sound needs a material medium for their propagation. **[1]**

Reason (R): Sound waves are mechanical waves.

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 bullet of mass 5 g travelling at a speed of 120 ms^{-1} penetrates deeply into the fixed target and is brought to rest in 0.01 s. Calculate: (a) the distance of penetration in the target, (b) the average force exerted on the bullet. **[2]**

34. The volume of 50 g substance is 20 cm^3. If the density of water is 1 g cm^{-3}, will the substance float or sink? **[2]**

OR

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.

35. Suppose you go up a tower 80 m high and throw a ball horizontally with a velocity of 20m/s. What will be the shape of the path followed by the ball? While falling, the motion of the ball will be a combination of two independent motions. Name these two motions. **[3]**

36. Two children are at opposite ends of an aluminium rod. One strikes the end of the rod with a stone. Find the ratio of times taken by the sound wave in air and in aluminium to reach the second child. **[3]**

37. A bullet travelling at 360 m/s strikes a block of soft wood. The mass of the bullet is 2.0 g. The bullet comes to rest after penetrating 10 cm into the wood. **[3]**

a) Find the average de-accceleration force exerted by the wood.

b) Find the time taken by the bullet to come to rest.

38. A vehicle of 1 tonne travelling by a speed of 60 ms^{-1} notices a cow on the road 9m ahead applies brakes. It stops just in front of the cow. **[4]**

i. Find out the KE of the vehicle before applying brakes.(1)

ii. Calculate the retarding force provided by the brakes. (1)

iii. How much time did it take to stop after the brakes were applied? (2)

OR

What is the work done by the braking force? (2)

39. i. A cube of side 5 cm is immersed in water and then in saturated salt solution. In which case, will it experience a greater buoyant force? If each side of the cube is reduced to 4 cm and then immersed in water, what will be the effect on the buoyant force experienced by the cube as compared to the first case for water. Give the reason for each case. **[5]**

ii. A ball weight 4 kg of density 4000 kg $m^{-3}$is completely immersed in water of density 10^{3}kg m^{-3}. Find the force of buoyancy on it. (Given g = 10 ms^{-2}.)

OR

A stone is dropped from a 100 m high tower. How long does it take to fall?

a. the first 50 m and

b. the second 50 m.

Solution

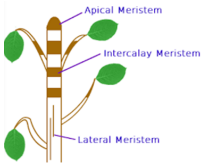
Section A

1.

(d) Z

Explanation:

X is apical meristem, Y is intercalary meristem, and Z is lateral meristem. The girth of stems or roots increases due to lateral meristems. Thus Z is the correct option.



2.

(b) Virchow

Explanation:

Rudolf Virchow presented the idea in 1855 that every cell arises from another (pre-existing) cell. This was an addition to the cell theory that was proposed earlier by **Matthias Jakob Schleiden** and **Theodor Schwann**.

3. **(a)** (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)

Explanation:

- Lysosomes are popularly known as 'suicidal bags'. They contain enzymes for the hydrolysis of all cell components in case of damage. They play a role in cell death.
- Centrioles are a very important part of centrosomes or spindle pole bodies that act as the microtubule-organizing centers in animal cells.
- Golgi apparatus consists of a system of membrane-bound vesicles. The proteins manufactured by the ribosomes are packed inside the vesicles.
- Smooth endoplasmic reticulum (SER) helps in the manufacture of fat molecules or lipids. Some of these lipids help in building the cell membrane (known as membrane biogenesis).

4.

(d) Tendons are non-fibrous tissue and fragile

Explanation:

Tendons are white fibrous connective tissues having great strength and join skeletal muscles with bones.

5.

(c) Rice

Explanation:

Rice is one of the chief grains of India. India has the largest area under rice cultivation, as it is one of the principal food crops.

6. **(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.

7.

(d) A is false and R is true.

Explanation:

The cell wall is found only in plant cells, outer to the cell membranes.

8.

(d) Competing for various resources of crops (plants)

Explanation:

The growth of weeds in the fields is harmful because they compete with other crops for nutrients, water, space, light. A **weed** is a plant considered undesirable in a particular situation, "a plant in the wrong place". A plant that is a weed in one context is not a weed when growing in a situation where it is in fact wanted, and where one species of plant is a valuable crop plant, another species in the same genus might be a serious weed. They compete with the desired plants for the resources that a plant typically needs, namely, direct sunlight, soil nutrients, water, and space for growth, providing hosts and vectors for plant pathogens giving them greater opportunity to infect and degrade the quality of the desired plants.

9.

(d) Catla

Explanation:

Catla is the fastest growing Indian major carp species and widely distributed throughout India, Nepal, Pakistan, Burma, and Bangladesh.

10. **(a) The main functions of ribosmes are :**

(i) They assemble amino acids to form specific proteins, proteins are essential to carry out cellular activities.

(ii) The process of production of proteins, the deoxyribonucleic acid produces mRNA by the process of DNA transcription.

(iii) The genetic message from the mRNA is translated into proteins during DNA translation.

(iv) The sequences of protein assembly during protein synthesis are specified in the mRNA.

If plasmolysed cell is kept in a hypertonic solution then, there will be no movement because they both have same concentration of water.

(v) he proteins that are synthesized by the ribosomes present in the cytoplasm are used in the cytoplasm itself. The proteins produced by the bound ribosomes are transported outside the cell.

(b) Cell Wall Functions:

(i) The plant cell wall provides definite shape, strength, rigidity, and protection against mechanical stress.

(ii) Helps in controlling cell expansion.

(iii) It helps in preventing water loss from the cell.

(iv) Involved in transporting of substances between and across the cell.

(v) It acts as a barrier between the cell interior and the outer environment.

11. Xylem is a complex permanent tissue. It is a conducting tissue of the plants. It consists of tracheids, vessels, xylem parenchyma and xylem fibres. The cells have thick walls. Many of the cells are dead. Tracheids and vessels are tubular structures. They transport water and mineral vertically. The xylem parenchyma stores food. The xylem parenchyma helps in the sideways conduction of water. Fibres are mainly supportive in function. Xylem moves materials in one direction – from the roots to the aerial parts.

OR

The outermost protective covering of the plants is called the epidermis. It is important for the plants due to its functions.

a. The main function of epidermis is protection against water loss. In desert plants, epidermal cells secrete a waxy, water-resistant layer of cutin on the outer surface of the plants which reduces loss of water.
b. It also consists of small pores called stomata which help in the exchange of gases with the atmosphere.
c. The function of the epidermal cells of the roots is absorption of water from the soil.
d. It also aids against mechanical injury and invasion by parasitic fungi.

12. **Hybridization -** Hybridization refers to crossing between genetically dissimilar organisms to produce offsprings with a desirable combination of characters.

Photoperiod - Duration of sunlight available to the plant is called as photoperiod. It affects the growth, flowering, and maturation of crops.

13. i. A represents companion cells, B represents sieve tubes, and C represents phloem parenchyma. which are small thin-walled cell containing dense and very active cytoplasm and large elongated nucleus.
ii. The sieve tubes end walls are perforated by numerous pores and are called sieve plates.
iii. The phloem parenchymatous cell performs the following functions:
    a. Storage of food.

b. Slow lateral conduction of food.

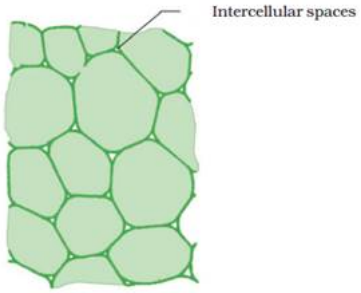
14. i. These two crops are selected in such a way that they have different nutrient requirements so they can grow simultaneously in the same field.
    ii. It reduces the risk and gives some insurance against failure od one of the crops.
    iii. Various methods for removal of weed, insect, and disease include pesticides, insecticides, fungicides, and mechanical removal.

15. i. Cellulose is a complex substance which provides structural strength to the plants.
    ii. Chromosomes are present as thread like structures packed inside the nucleus of a plant cell or animal cell. Each chromosome is made up of protein and a single molecule of DNA (deoxyribonucleic acid).
    Therefore, chromosomes are made of DNA and protein
    iii. Plasmolysis in a plant cell is defined as the process of shrinkage of the cytoplasm as a result of loss of water from the cell. It occurs when plant cells are placed in a solution that has a higher concentration of solutes than the cell does.
    OR
    Hypertonic solution.

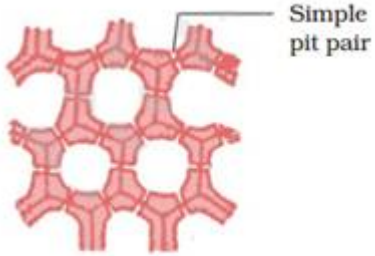
16. i. When human red blood cells are placed in hypotonic salt/sugar solution they swell due to endosmosis.
    ii. Plant cell shrinks when kept in hypertonic solution because the concentration of the solvent is more inside the cell. It shrinks due to exosmosis.
    iii. Lysosomes are known as suicidal bags because, during the breakdown of cell structure, lysosome bursts and enzymes eat up their own cells.

OR

Parenchyma	Sclerenchyma
Cells are live.	Cells are dead.
Cells have thin cell walls.	The cell wall is thick due to the deposition of lignin.
Intercellular spaces are present between cells.	No intercellular spaces are found between the cells.
Cells are oval in shape.	Cells are long in shape.
Some cells contain chloroplast.	The chloroplast is absent.
Storage of food is a major function.	Structural rigidity is the main function.
Found in soft parts.	Found in hard parts.



T.S. Parenchyma



T.S. Sclerenchyma

Section B

17.

(d) Iodine

Explanation:

The process of changing solid directly into gases without changing into a liquid is called sublimation. sugar, urea, and ice are not sublime substances, Iodine, ammonium chloride, naphthalene balls, camphor is a sublime substance.

18.

(d) a = multiply by 22.4 L, b = divide by 22.4 L

Explanation:

Volume of gas at STP = No. of moles $\underbrace{\times 22.4 \text{ L}}_{a}$

No. of moles = Volume of gas at STP $\underbrace{\div 22.4 \text{ L}}_{b}$

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

Explanation:

Light is scattered by colloidal particles, making the path of the beam visible.

20.

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

Explanation:

Atomic number (Z) of a chemical element is the number of protons in the nucleus of that atom. It is a characteristic of the element and determines its place in the periodic table. The mass of an atom of a chemical element is equivalent to the number of protons and neutrons in the atom (the mass number) or to the average number allowing for the relative abundance of the different isotopes. Isotopes are atoms with the same number of protons but different number of neutrons. It can also be said that isotopes are atoms of the same element with the same atomic number but different mass number. Isobars are atoms (nuclides) of different chemical elements that have the same number of nucleons.

21.

(c) $BiPO_4$

Explanation:

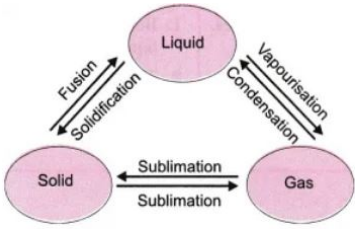
$BiPO_4$ is the correct formula, its name is Bismuth phosphate.

22.

(c) (A) Vapourisation (B) Condensation

Explanation:

The correct figure is:



23. **(a)** Starch + Water

Explanation:

Starch forms a colloid in water (hot water).

24.

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

Explanation:

Number of atoms present in a molecule of a gaseous element is called atomicity. e.g., O_2 has two atoms and hence, its atomicity is 2.

25. When salt is heated, it does not get charrd but sugar gets charred on heating. When salt is dissolved in water, the solution conducts electricity. This done not happen with aqueous solution of sugar.

26. They do not come closer because of the presence of either positive or negative charge on them. Due to mutual repulsion, these particles remain scattered in a colloidal solution.

OR

Elements	Compounds
Elements are pure substances that cannot be broken down	Compounds are those pure substances that can be broken down

into simpler substances by any known physical or chemical means..	into their constituent elements by chemical or electrochemical reactions.
Elements are made up of only one kind of atoms.	Compounds are made up of more than one kind of atoms.
Examples of elements are copper, oxygen, iron.	Examples of compounds are water, methane, sugar.

27. i.

Particles	Discoverer
Electrons	J.J. Thomson
Protons	Rutherford
Neutrons	Chadwick

ii. View point in support of scientist as he discourages superstition.

28. i. The process by which a substance changes from a solid state to a liquid state is called fusion. Fusion is also called melting.

ii. The temperature at which the solid changes into liquid at the atmospheric pressure is called melting point. For example, ice melts at 0°C to form water.

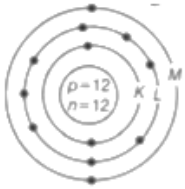
iii. The amount of heat energy released or absorbed when a solid changing to liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.

OR

latent heat, energy absorbed or released by a substance during achange in its physical state (phase) that occurs without changing its temperature.

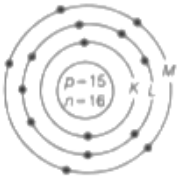
29. i. An outermost shell, which has eight electrons is said to possess an octet. Elements attain their octet by sharing, gaining or losing electrons.

ii. Atomic structure of Mg



K L M
$_{12}Mg$ = 2, 8, 2

Atomic structure of P



K L M
$_{15}P$ = 2, 8, 5

OR

When atomic number Z = 3, the element will have 3 protons in its nucleus.

Since the atom is electrically neutral, the number of electrons in its shells will be equal to the number of protons .

The element will have 3 electrons in its different shells.

The maximum number of electrons that can be accommodated in the first orbit (n = 1) or K-shell will be = $2n^2 = 2$

So, the 3 electrons in the element would be distributed as 2, 1.

The number of valence electrons (i.e. electrons in the outermost shell) is 1.

Valency = number of valence electrons (for 4 or lesser valence electrons)

The element can easily give away its outermost single electron for achieving a duplet (Helium) configuration.

The valency of the element is 1. The given element is Lithium (Li).

Section C

30.

(b) third law of motion

Explanation:

As the sailor jumps forward out of a rowing boat, the force on the boat moves it backwards. Thus, when one object exerts a force on another object, the second object instantaneously exerts a force back on the first. Hence, this is an example of the third law of motion.

31.

(d) In the direction of A

Explanation:

The momentum after the collision is in the direction of A because of less momentum.

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

Explanation:

Sound needs a material medium like solid, liquid, or a gas to travel and be heard. Sound waves are mechanical waves because it require a material medium for their propagation.

33. m = 5 g = 5 $\times$ 10^{-3} kg u = 120 ms^{-1}, v = 0, t = 0.01s

a. From the relation v = u + at

We have 0 = 120 + a $\times$ 0.01

or a $= -\frac{120}{0.01}$ = -12000 ms^{-2} (the negative sign here shows retardation)

Distance of penetration in the target

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

S = 120 $\times$ 0.01 + $\frac{1}{2}$ $\times$ (-12000) $\times$ $(0.01)^2$ = 0.6 m

b. Average retarding force F = ma = (5 $\times 10^{-3}$) $\times$ (12000) = 60N

34. Mass of substance m = 50 g

Volume of substance V = 20 cm^3

Therefore density of substance is

$D = \frac{M}{V} = \frac{50}{20}$ = 2.5 g cm^{-3}

The substance will sink in water, because its density is more than that of water.

OR

Mass of object (m) = 40 kg

Height (h) = 5 m

Acc. due to gravity (g) = 10 ms^{-2}

∴ P.E. at a height of 5 m (PE) = mgh

= 40 × 10 × 5 = 2000J

P.E. at a half way height, i.e. : 2.5 m (PE)

= mgh

= 40 × 10 × 2.5

= 1000 J

Decrease in P.E. = Increase in K.E.

= 2000 - 1000

= 1000 J

35. The shape of the path followed by the ball is parabolic.

Vertically downward motion is due to gravitational acceleration. Horizontal motion is due to zero acceleration.

36. Since speed of sound in air = 344 m/s

and speed of sound in aluminium = 6420 m/s

we know that v = distance/time therefore time = d/v

time taken by sound wave in air/time taken by sound wave in aluminium

$= \frac{d}{344} : \frac{d}{6420} = \frac{6420}{344} = \frac{18.66}{1}$

the sound will take 18.66 times more time through air than in aluminium in reaching other boy.

37. Initial velocity,u = 360 m/s

Final Velocity,v =0

Distance Travelled ,S = 10 cm = 0.1 m

Acceleration,a = ?

From third equation of motion, $v^2 = u^2 + 2as$

$\implies 0 = (360)^2 + 2a\,(0.1)$

$\implies a = \frac{-129600}{2} = -648000 m/s^2$

Now,

mass of the bullet,m= 2.0g = 0.002 kg

Force,F = ma

$= 0.002 \times (-648000)$

$= -1296\,N$

∴The average de-accelerating force exerted by the wood $= -1296\,N$

(b)

From first equation of motion,$v = u + at$

$\implies 0 = 360 + (-648000)t$

$\implies t = 5.56 \times 10^{-4} s$

Therefore,time taken by the bullet to come to rest $= 5.56 \times 10^{-4} s$

38. i. Given, mass of the vehicle, m = 1 tonne = 1000 kg

Initial speed, u = 60 ms^{-1}

Distance between vehicle and the cow, s = 9 m

Final velocity, v = 0

Kinetic Energy is the energy possessed by a body due to its motion. The kinetic energy of an object increases with its speed.

KE of vehicle before applying brakes is given by = $\frac{1}{2}$ mu^2 = $\frac{1}{2}$ × 1000 × 60 × 60 = 1800000 J = 1800 kJ

ii. Given, mass of the vehicle, m = 1 tonne = 1000 kg

Initial speed, u = 60 ms^{-1}

Distance between vehicle and the cow, s = 9 m

Final velocity, v = 0

From the third equation of motion,

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

$(0)^2 - (60)^2 = 2 \times a \times 9$

$\Rightarrow a = -200\ ms^{-2}$

So, retarding force provided by the brakes = ma = 1000 × (-200) = -200000 N

iii. Given, mass of the vehicle, m = 1 tonne = 1000 kg

Initial speed, u = 60 ms^{-1}

Distance between vehicle and the cow, s = 9 m

Final velocity, v = 0

Now, again from the second equation of motion,

$s = ut + \frac{1}{2} at^2 \Rightarrow 9 = 60t + \frac{1}{2} \times (-200)\ t^2$

or $9 = 60t - 100t^2$

or $100t^2 - 60t + 9 = 0 \Rightarrow (10t - 3)^2 = 0$

or $10t - 3 = 0 \Rightarrow t = \frac{3}{10} = 0.3$ s

OR

Given, mass of the vehicle, m = 1 tonne = 1000 kg

Initial speed, u = 60 ms^{-1}

Distance between vehicle and the cow, s = 9 m

Final velocity, v = 0

So, work done by the braking force is given by = Fs = -200000 × 9 = -1800000 J = -1800 kJ

39. i. The cube will experience a greater buoyant force in saturated salt solution than in water because density of saturated salt solution is more than the density of water. If each side of the cube is reduced to 4 cm, it will result in reduction in volume of the cube. Hence, the buoyant force experienced by it will reduce in water.

ii. Buoyant force = weight of displaced water

= density of water × volume of displaced water × g

= 1000 × $\frac{4}{4000}$ × 10 [$\because$ volume = $\frac{weight}{density}$]

= 10 N

OR

Initial velocity ,u=0

Total height, h = 100 m

a. Let, for the first 50 m the time taken by the stone be 't' sec.

S=-50 m (- ve sign shows the stone falls in downward direction)

g = -10 m/s^2

$h = s = ut + \frac{1}{2}gt_1^2$

$\implies -50 = 0 + \frac{1}{2}(-10)t_1^2$

$\implies -50 = -5t_1^2$

$\implies \frac{50}{5} = t_1^2$

$\implies t_1^2$ = 10

$\implies t_1 = \sqrt{10}$

$\therefore$ t_1 = 3.16 sec

b. For the entire journey,let the time taken be T

u = 0

S = -100 m

$a = -10m/s^2$

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

$\Rightarrow -100 = 0 + \frac{1}{2} \times (-10)\,T^2$

$\Rightarrow$ T_2 = 20

$\Rightarrow T = \sqrt{20}$

$\Rightarrow$ T = 4.47 sec

$\therefore$ Time taken to fall through the next 50 m = T - t_1 = 4.47 - 3.16 = 1.31 sec