CBSE
Class IX Science

Time: 3 hrs **Total Marks: 80**

General Instructions:

1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers **1** and **2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section A** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section A** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section A** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section B** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

Section A

1. What is crop rotation? (1)

2. Define nitrogen fixation. (1)

3. List any two measures to prevent soil erosion. (2)

4. A car from rest moves with a uniform acceleration of 3 m/s^2 for 9 minutes. Calculate the acquired speed and the distance travelled in this time. (2)

5. Name the physical quantity whose unit is (2)

(i) $kgms^{-2}$

(ii) Nm^2kg^{-2}

6. Explain the drawbacks of Rutherford's model of an atom. (3)

7. (3)

(a) Discuss two ways of incorporating desirable characteristics into crop varieties.

(b) How are crops selected for intercropping?

OR

What harm can be caused to crops if they are excessively irrigated?

8. Give reasons: (3)

(a) What happens when acetone is poured on the palm?

(b) Water kept in an earthen pot becomes cool in summer.

(c) We are able to sip hot tea from a saucer rather than from a cup.

9. A wave pulse on a string moves at a distance of 8 m in 0.05 s. (3)

(a) Find the velocity of the pulse.

(b) What would be the wavelength of the wave on the same string if its frequency is 200 Hz?

10. Although a stone and the Earth attract each other with equal force, why do we observe that only the stone falls towards the Earth but the Earth does not rise towards the stone? Explain. (3)

11. A wooden cuboid has mass of 10 kg. The length, breadth and height of this wooden cuboid are 100 cm, 50 cm and 20 cm, respectively. Find the pressure on the floor on which this block is kept. (3)

OR

Define 1 joule of work. What is the relation between joule and erg?

12. How many grams of oxygen gas contain the same number of molecules as 16 grams of sulphur dioxide gas? (O = 16 u, S = 2 u) (3)

OR

Write the chemical formula of the following using the criss-cross method: (3)

(a) Calcium nitride

(b) Calcium hydride

(c) Sodium carbonate

13. Neha was suffering from chicken pox for two weeks. Her friends call her and insist that she join them for the school picnic. She refuses and decides to stay at home. (3)

(a) Which organism causes chicken pox?

(b) List another disease which spreads through the same mode of transmission.

(c) Mention any two values exhibited by Neha by not joining her friends for the picnic.

14. Why does a person start vomiting after consuming a concentrated salt solution? (3)

15. What may be the reasons for mass mortality of fish in a pond? (3)

16. (a) Name the tissue which (3)

(i) Stores fat in our body

(ii) Connects muscles to bones

(iii) Transports food in plants

(b) List any two points of differences between collenchyma and sclerenchyma. (2)

17. (a) Work done by a force is given by the equation $W = F \cos \theta \times s$. Determine and explain the effect of work done due to a gradually decreasing angle 'θ'. (3)

(b) A car is being driven by a force of 5×10^{10} N. When travelling at the speed of 10 m/s, it takes two minutes for this car to reach the river side. Calculate the work done. (2)

18. Compare the properties of solids, liquids and gases with respect to (5)

(i) Shape

(ii) Volume

(iii) Compressibility

(iv) Diffusion

(v) Fluidity or rigidity

OR

What is covalency? Explain the formation of a covalent bond with the help of an example.

19.

(a) A man weighs 300 N on the surface of the Earth. If he were taken to the Moon, his weight would be 50 N. Calculate the mass of this man on the Moon ($g = 10\ m/s^2$). (3)

(b) A man hears an echo of thunder 2 seconds after lightning strikes. Calculate the distance of lightning from the man (Speed of sound in air = 330 m/s). (2)

OR

(a) Using Newton's law of motion, derive the relation between force and acceleration.

(b) Define one newton.

(c) Which would require a greater force to accelerate—a 0.5 kg mass at 5 m/s^2 or a 4 kg mass at 2 m/s^2? Give reasons.

20. (5)

(a) Why do biologists think that arthropods are the most successful of all animals?

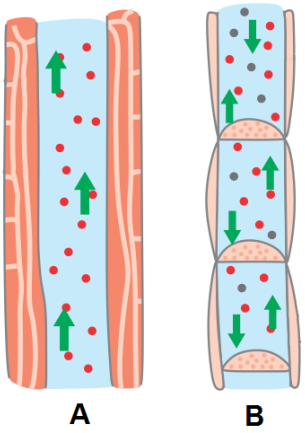
(b) What is venation? Mention any one plant which bears the following type of venation.

21. (a) What happens when a liquid is left exposed to air?
(b) List the factors which affect the rate of evaporation and explain their effect on it.

(5)

Section B

22. Observe the figures A and B given below. (2)



(a) List the elements present in tissue A.
(b) Which of these tissues helps in the transport of food in plants?

23. Rekha observed rhizome and circinate leaves in the given specimen. (2)

(a) Which specimen has she observed?
(b) To which group of plants does this specimen belong?

24. How will you separate the following: (2)
(i) Salt and sea water mixture
(ii) Poison from contents of bladder
(iii) Components of ink
(iv) Pure alum from impure sample

25. Describe what happens when we burn a piece of paper. What type of a change is this?(2)

26. While determining the density of the material of a body, a student recorded the following observations (2)

(a) Mass of the body = 62.4 g

(b) Reading of the water level in the measuring cylinder without the body = 16.4 mL

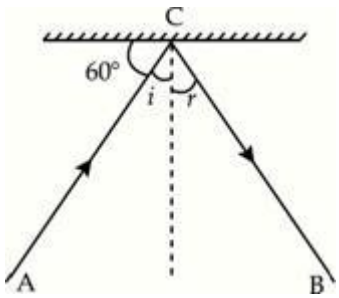
(c) Reading of the water level in the measuring cylinder with the body = 24.4 mL

Based on these observations, what will be the density of material of the body in kg m^{-3}?

OR

To establish the relationship between the weight of a wooden block lying on a horizontal surface and the minimum force required to just move it using a spring balance, two students performed the experiment with the cuboid of the same dimensions and the same weight. Student A placed the cuboid on sand paper, while Student B placed it on wood mica. What is the relation between the applied forces in the spring balance for the two substances? Why?

27. From the figure given below, what is the measure of the angle of reflection? (2)



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Solution

Section A

1. The practice of growing different types of crops alternately in the same field in pre-planned succession is called crop rotation.

2. Conversion of inert elemental nitrogen gas into its biologically usable form is called nitrogen fixation.

3. Measures to prevent soil erosion:
(a) Intensive cropping
(b) Reforestation
(c) Terrace farming

4. When a car is moving from rest, its initial velocity (u) is zero.
The distance travelled (s) by this car can be found by using the second equation of motion.

$u = 0$ m/s

$a = 3$ m/s^2

$t = 9$ min $= 540$ s

To find the distance we use

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

$$\therefore s = (0).540 + \frac{1}{2}(3).(540)^2$$

$s = 437400$ m $= 437.4$ km.

Therefore, the distance travelled by this car is 437.4 km.

Calculating the speed of this car,

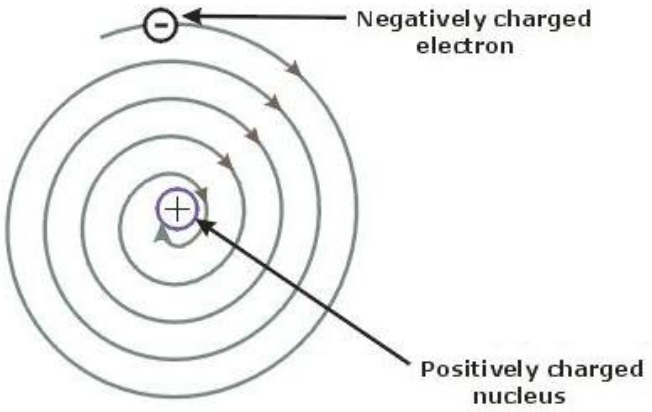
$$\text{Speed} = \frac{\text{Distance}}{\text{time}} = \frac{437400}{540} = 810 \text{ m/s}$$

The speed of this car is 810 m/s.

5.
(i) Force
(ii) Gravitational constant

6. Drawbacks of Rutherford's Model of an Atom:

- Rutherford's atomic model could not explain how moving electrons could remain in their orbits.
- Any charged particle during acceleration would radiate energy, and while revolving, it would lose its energy and eventually fall into the nucleus.
- This means that the atom would be highly unstable.
- But, matter is composed of stable atoms.
- So, the major drawback of Rutherford's atomic model was that it could not explain the stability of atoms.



7.

(a) Desirable characteristics can be incorporated into crop varieties by the following methods:

- Hybridisation: Selected plants with one or more desirable traits are crossed with one another.
- Genetic engineering: Desirable characteristics are introduced into selected plants with the help of techniques of biotechnology.

(b) Crops are selected for intercropping based on different nutrient requirements and different sowing and harvesting patterns of crops, e.g. soybean and maize.

OR

Effects due to excessive irrigation of crops:

- Soil erosion
- Changes in the composition of soil due to solubilisation of some of the minerals from the soil
- Water pollution

8.

(a)When acetone is poured on the palm, it takes up the latent heat of vaporisation required to change from the liquid state to vapour state from our hand. The hand loses heat and gets cooled.

(b)The earthen pot has small pores in its walls. Some of the water continuously seeps out from these pores. This water evaporates and absorbs heat of vaporisation from the remaining water. Thus, the remaining water loses heat and gets cooled.

(c) Larger the surface area, faster will be the cooling. Evaporation is a surface phenomenon. The particles of tea on the surface absorb the heat for vaporisation from the remaining particles of the tea and evaporate. The tea thus loses heat and cools faster.

9. Distance travelled by the pulse 's' = 8 m
Time taken 't' = 0.05 s
Frequency 'ν' = 200 Hz
(a) We know that

$$v = \frac{\text{distance}}{\text{time}} = \frac{s}{t} = \frac{8}{0.05} = 160 \text{ m/s}$$

Hence, the velocity of the pulse is 160 m/s.

(b) We know that

$$v = \nu\lambda$$

$$\lambda = \frac{v}{\nu} = \frac{160}{200} = 0.8 \text{ m}$$

Hence, the wavelength of the pulse is 0.8 m.

10. Force (F) acting between the Earth (mass M) and the stone of mass (m) separated by the distance (r) by universal law of gravitation is given by the equation $F = G \times \frac{M.m}{r^2}$.

The mass of stone is too less (negligible) when compared to the mass of the Earth which is 6×10^{24} kg. Thus, the stone falls on the Earth and the Earth does not rise towards the Sun.

11. The pressure is the ratio of force (F) exerted by a body to the area (A) upon which the body is exerting the force. Also, weight (W) is the force exerted by a body due to the earth's gravitational pull, i.e. F = W.

$W = mg$

Acceleration due to gravity $(g) = 10 \text{ m/s}^2$

$\therefore W = 10 \times 10 = 100 \text{ N}$

$\text{Pressure (P)} = \frac{\text{Force (F)}}{\text{Area (A)}}$

Area of the surface of the cuboid (A)= $\ell \times b$

Assuming the surface of 50×20 cm to be in contact with the floor.

$A = 50 \times 20 = 1000 \text{ cm}^2 = 0.1 \text{ m}^2$

$\therefore P = \frac{100}{0.1} = 1000 \text{ N/m}^2$

The pressure exerted by the block on the floor is 1000 N/m^2.

Assuming the surface of 50×20 cm to be in contact with the floor.

$A = 100 \times 50 = 15000 \text{ cm}^2 = 1.5 \text{ m}^2$

$\therefore P = \frac{100}{1.5} = 66.6 \text{ N/m}^2$

The pressure exerted by the block on the floor is 66.6 N/m^2.

OR

Work is said to be 1 joule when a force of 1 Newton acting on an object displaces it through 1 metre in the direction of the force.

Relation between joule and erg is

$1 \text{ J} = 1 \text{ N} \times 1 \text{ m}$

Now, $1 \text{ N} = 10^5$ dyne

$1 \text{ J} = 10^5 \text{ dyne} \times 10^2 \text{ cm}$

$1 \text{ J} = 10^7 \text{ dyne} \times \text{cm} = 10^7 \text{ erg}$

$1 \text{ J} = 10^7 \text{ erg}$

12. 1 mole of sulphur dioxide, SO_2 = Mass of S + Mass of 2 'O'

$= 32 + 2 \times 16$

$= 64$ grams

Now, 64 g of sulphur dioxide = 1 mole

$\text{So, 16 g of Sulphur dioxide} = \frac{1}{64} \times 16 \text{ moles}$

$= \frac{1}{4} \text{ moles}$

1/4 mole of sulphur dioxide will have the same number of molecules as 1/4 mole of oxygen. So, we convert 1/4 mole of oxygen into mass in grams.

1 mole of oxygen, O_2 = Mass of 2 'O' atoms

= 2 × 16

= 32 grams

Now, 1 mole of oxygen = 32 grams

So, 1 / 4 mole of oxygen $= 32 \times \frac{1}{4}$

$= 8$ grams

Thus, 8 grams of oxygen will contain the same number of molecules as 16 grams of sulphur dioxide.

OR

(a)

Calcium nitride

Symbol: Ca N

Charge: 2+ 3-

Formula: Ca_3N_2

(b)

Calcium hydroxide

Symbol: Ca OH

Charge: 2+ 1-

Formula: $Ca(OH)_2$

(c)

Sodium carbonate

Symbol: Na CO_3

Charge: 1+ 2-

Formula: Na_2CO_3

13.

(a) Chicken pox is caused by Varicella zoster virus.

(b) Like chicken pox, influenza also spreads through the air by coughing or sneezing.

(c) Sensitivity towards the community, social awareness and self-discipline are some of the values exhibited by Neha by not joining her friends for the picnic.

14.

(a) Concentrated salt solution is a hypertonic solution.

(b) When a person consumes a hypertonic solution, it causes irritation and excessive dehydration in the walls of the alimentary canal due to exosmosis.

(c) There is uncomfortable stretching of the digestive muscles which causes reverse movements and ultimately results in vomiting.

15. In a pond, mass mortality of fish may occur due to

(a) Release of pesticides from nearby crop fields

(b) Release of toxic industrial wastes

(c) Mixing of hot water from an industry or a thermal power plant

(d) Release of wastes rich in heavy metals

(e) Blockage of gills of fish by some suspended pollutant

(f) Absence of enough oxygen for the respiration of fish

16. (a)

(i) Adipose tissue

(ii) Tendon

(iii) Phloem

(b) Differences between collenchyma and sclerenchyma: (Any two points)

Collenchyma	**Sclerenchyma**
1. Consists of living cells	1. Consists of dead cells
2. Cells contain cytoplasm	2. Cells are empty
3. Cell wall is made of cellulose	3. Cell wall is made of lignin
4. Cell wall thickening is not uniform	4. Cell wall thickening is uniform
5. Lumen of the cell is wide	5. Lumen of the cell is narrow

17. (a)

Work (W) done by a force (F) is given by

$W = F \times s \cos\theta$

The range of angle 'θ' in simple trigonometry is from 0° to 90°

$\cos 0 = 1$ and $\cos 90 = 0$

Therefore, as the angle between directon of force and direction of motion decreases, the work done by a force increases.

(b)

Work (W) = Force (F) $\times$ Displacement (s) ...(1)

Force (F)= 5×10^{10} N

In this case of motion, the displacement of the car is equal to the distance travelled by the car.

Speed (s)= $\frac{\text{Distance}}{\text{time}} = \frac{\text{Displacement}}{\text{time}}$

Speed (s) = 10 m/s

Time of motion (t) = 2 min = 120 secs

$\therefore$ Displacement (s) = 1200 m

Substituting the above value of displacement in equation (1)

Work done = $5 \times 10^{10} \times 1200 = 6 \times 10^{13}$ J

So, work done by the car to reach the river side is 6×10^{13} joules.

18.

Properties	**Solids**	**Liquids**	**Gases**
Shape	Definite shape (strong intermolecular forces)	Do not have a definite shape, takes the shape of the container in which they are kept.	No definite shape (weak intermolecular forces)
Volume	Definite volume (The spaces between the particles are fixed.)	Definite volume (The space between the particles is slightly more as compared to solids, but still very less as compared to gases. The particles of liquids can slip and slide over each other.)	No definite volume (The spaces between the particles are not fixed.)
Compressibility	Negligible	Negligible	High
Diffusion	Can diffuse into liquids	Diffusion is higher than solids	Highly diffusible (Rate of diffusion is highest in gases.)
Fluidity or rigidity	Very rigid and cannot flow from one place to another.	Less rigid and can easily flow. Liquids show a property called viscosity. More viscous liquids flow more slowly, while less viscous liquids flow easily.	No rigidity and can flow easily.

OR

Covalency

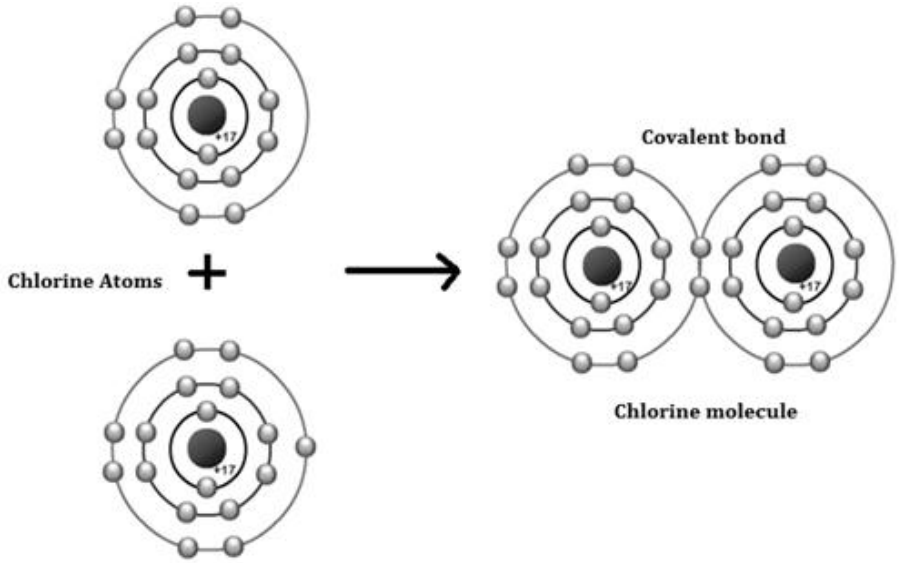
- The number of electrons shared by one atom of an element to achieve the nearest inert gas electron configuration is known as its covalency.

Formation of a Covalent Bond

- When both atoms in a reaction need to gain electrons to complete their octet, sharing of electrons takes place.
- Let us study how the chlorine molecule is formed to understand the formation of a covalent bond.

Formation of chlorine molecule

- A chlorine atom has 7 electrons in the outermost shell.
- When two chlorine atoms combine, they share one electron each to form a shared pair of electrons, thus completing both their octets. Hence, the chlorine molecule exists as Cl_2.



Formation of Covalent bond between two Chlorine atoms

19. (a)

Weight of man on the Earth (W_{Earth}) = 300 N

acceleration due to gravity (g_{Earth})= 10 m/s^2

Weight α acceleration due to gravity

$W_{Earth} = m_{Earth} \times g_{Earth}$

$\therefore m_{Earth} = \frac{300}{10} = 30 \text{ kg}$

Weight of man on the moon (W_{moon}) = 50 N

$\therefore \frac{W_{Moon}}{W_{Earth}} = \frac{50}{300} = \frac{1}{6}$

$\therefore \frac{m_{moon}}{m_{Earth}} = \frac{1}{6}$

$\frac{m_{moon}}{30} = \frac{1}{6}$

$\therefore m_{moon} = 5 \text{ kg}$

So, the mass of the man on the Moon is 5 kg.

(b) We know that

$\text{Speed of sound in air (v)} = \frac{\text{Distance}}{\text{time}}$

$330 = \frac{\text{Distance}}{2}$

$\therefore \text{Distance} = 660 \text{ m}$

So, the distance between the man and the point of lightning is 660 m.

OR

(a) Let m be the mass of an object moving with initial velocity u. Let a constant force F act on the object for time t so that its final velocity becomes v.

Then, the initial momentum of the object $P_1 = mu$

Final momentum of the object $P_2 = mv$

Change in momentum = $P_2 - P_1$

$= mv - mu$

$= m (v - u)$

The rate of change of momentum = $m (v - u)/t$

According to Newton's second law of motion, the rate of change of momentum is directly proportional to the force applied.

$$F \propto \frac{m(v-u)}{t}$$

$$F = \frac{km(v-u)}{t}$$

$$F = kma$$

The unit of force is so chosen that the value of the constant k becomes one.

So, F = ma

(b) One newton is the amount of force exerted on a body of mass 1 kg to produce an acceleration of 1 m/s^2.

(c)

$$F_1 = 0.5 \text{ kg} \times 5 \text{ m/s}^2 = 2.5 \text{ N}$$

$$F_2 = 4 \text{ kg} \times 2 \text{ m/s}^2 = 8 \text{ N}$$

Hence, 4 kg mass at 2 m/s^2 will require a greater force.

20.

(a)

(i) The central distinguishing feature of arthropods is the presence of a chitinous exoskeleton or cuticle.

(ii) The exoskeleton protects the internal organs; assists in body movement; defends against predators, parasites and pathogens; isolates the animals from the environment and protects land arthropods from desiccation.

(iii) The presence of jointed appendages help in the escape from predators.

As a result, biologists think that arthropods are the most successful of all animals.

(b) The method of arrangement of veins and veinlets in the leaf lamina is called venation. The given figure shows reticulate venation in leaves. Reticulate venation is a characteristic feature of leaves of dicot plants such as rose, mango and sunflower.

21.

(a) When a liquid is left exposed to air, its volume gradually decreases because of evaporation of some of the water from its surface.

(b) <u>Four factors affecting the rate of evaporation:</u>

1. Surface area: Evaporation is a surface phenomenon. If the surface area is increased, the rate of evaporation increases.

2. Temperature: With the increase of temperature, more particles get enough kinetic energy to go into the vapour state, and hence, the rate of evaporation increases.

3. Humidity: If the humidity of air is high, then the rate of evaporation decreases.

4. Wind speed: With the increase in wind speed, the particles of water vapour move away with the wind, decreasing the amount of water vapour in the surroundings; hence, the rate of evaporation increases.

Section B

22. A – Xylem, B – Phloem

(a) Elements of tissue A (Xylem) – Tracheids, vessels, xylem parenchyma and xylem sclerenchyma

(b) Tissue B or phloem helps in the transport of food from the leaves to the other parts of the plant.

23.

(a) The specimen with rhizome and circinate leaves is that of fern.

(b) Fern belongs to Division Pteridophyta.

24.

(i) Salt and sea water: Evaporation

(ii) Poison from contents of bladder: Chromatography

(iii) Components of ink: Evaporation

(iv) Pure alum from impure sample: Crystallisation

25. When a piece of paper is burnt, entirely new substances such as carbon dioxide, water vapour, smoke and ash are formed. Hence, burning of paper is a chemical change.

26.

Given : The mass of the body = 62. 4 g

Volume of the body = 24.4 -16.4 = 8 mL = 8 cm^3

$$\text{Density of the material of the body} = \frac{\text{Mass}}{\text{Volume}} = \frac{62.4}{8} = 7.8\ g/cm^3$$

$$= \frac{7.8 \times 100 \times 100 \times 100}{1000} = 7800\ kg/m^3$$

OR

The applied force as shown by the spring balance is more for sand paper than for wood mica because rough surfaces offer more friction, and between the two, sand paper is a more frictional surface.

27. $\angle i = 90° - 60° = 30°$

$\angle i = \angle r = 30°$

Hence, the angle of reflection is 30°