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

General Instructions:
- The question paper comprises five sections – A, B, C, D and E. You are to attempt all the sections.
- All questions are compulsory.
- Internal choice is given in sections B, C, D and E.
- Question numbers 1 and 2 in Section A are one mark questions. They are to be answered in one word or in one sentence.
- Question numbers 3 to 5 in Section B are two marks questions. These are to be answered in about 30 words each.
- Question numbers 6 to 15 in Section C are three marks questions. These are to be answered in about 50 words each.
- Question numbers 16 to 21 in Section D are five marks questions. These are to be answered in about 70 words each.
- Question numbers 22 to 27 in Section E are based on practical skills. Each question is a two marks question. These are to be answered in brief.

Section A

1. What are weeds? Give two examples.   (1)

2. Define ammonification and nitrification.   (1)

Section B

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

4. A car from rest moves with a uniform acceleration of 6 m/s^2 for 12 minutes. Calculate the acquired speed and the distance travelled in this time.   (2)

OR

What are the equations of motion when gravity is acting on the falling object?

5. Explain the term atomicity. Give examples of diatomic elements.   (2)

Section C

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

7. What is pasturage and how is it important? (3)

OR

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

8. Give reason: (3)
(a) A bucket of water is cooled more quickly by placing ice in it and not by placing it on ice.
(b) 1 kg of water at 0°C contains more heat than 1 kg of ice at 0°C.
(c) 1 kg of steam at 100°C has more heat than water at the same temperature.

9. A wave pulse on a string moves at a distance of 10 m in 0.6 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 150 Hz?

10. (3)
a) What is recoil velocity?
b) State and explain conservation of momentum.

11. A wooden cuboid has a mass of 20 kg. The length, breadth and height of this wooden cuboid are 70 cm, 60cm and 50 cm, respectively. Find the pressure on the floor on which this block is kept with its breadth and height in contact with the floor. (3)

OR

Define work. State the SI unit of work. Work is which type of quantity?

12. How many grams of oxygen contain the same number of molecules as 32 grams of sulphur dioxide? (O = 16 u, S = 2 u) (3)

OR

Write the chemical formula of the following using the criss-cross method:
(a) Calcium chloride
(b) Magnesium hydroxide
(c) Potassium 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. Differentiate between diffusion and osmosis. What is its importance? (3)

15. Plants in deep soil have more mechanical strength than plants in shallow soil. Why? (3)

Section D

16. (5)
    (a) Name the tissue which
        (i) Fills the space inside organs
        (ii) Connects bones to bones
        (iii) Transports water in plants
    (b) List any two points of differences between parenchyma and collenchyma.

17. (5)
    (a) Work done in moving the object through a distance of 30 m is 200 J. The object kept on a flat surface is pulled with the help of a string which makes an angle of 60° with the plane surface. Find the force acting on the object.
    (b) A car is being driven by a force of 5000 N. When travelling at the speed of 20m/s, it takes 1.5 minutes for this car to reach the river side. Calculate the work done.

18. Suppose there are five states of matter A, B, C, D and E. State A has a fixed volume but no fixed shape. State B can be compressed very easily by applying pressure and state C has a fixed shape as well as a fixed volume. State D is a mixture of free electrons and ions, whereas state E is named after an Indian scientist and a famous physicist. Based on the above information, answer the following:
    (a) Name the physical states (i) A, (ii) B, (iii) C, (iv) D and (v) E.
    (b) Name one substance belonging to state C which can directly change into vapours on heating. What is this process known as?
    (c) Name one substance which normally belongs to state B but whose solid state changes directly into the gaseous state.
    (d) Name the most common substance belonging to state A.
    (e) Which state of matter makes the Sun and other stars to glow?

OR

Write the molecular formulae for the following compounds:
(a) Copper (II) bromide
(b) Aluminium (III) nitrite
(c) Calcium (II) phosphate
(d) Magnesium (II) acetate
(e) Mercury (II) chloride

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 a clap 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) Write any three points for the importance of classification.
(b) Name the system that helps in circulating water for food and oxygen in poriferans. What is their habitat?
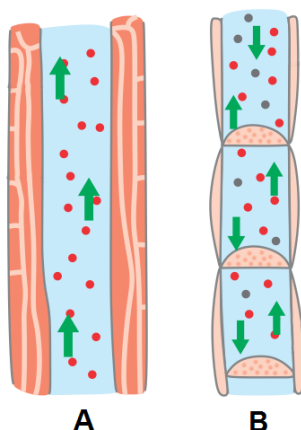
OR

(a) Write four characteristic features of Protochordates.
(b) Give reasons:
    (i) Frogs have both skin and lungs for breathing.
    (ii) Whale is a mammal not a fish.

21. Give five characteristics associated with the gas, liquid and solid states.   (5)

Section E

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

A   **B**

    (a) List the elements present in tissue B.

    (b) Which of these tissues helps in the transport of food in plants?

OR

    (a) The slide given to you for identification consists of long, narrow, dead cells which have thick boundaries which provide strength to the plant parts. Which plant tissue slide was shown to you?

    (b) Which plant tissue yields jute and coir?

23. Rekha observed the 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) Ammonium chloride and sand

    (ii) Pigments of leaf

    (iii) Nitrogen from liquid air

    (iv) Iodine and chloroform

25. Describe what happens when we toast bread. What type of change is this? (2)

OR

When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate is formed. Identify the type of reaction and give its balanced chemical equation.

26. While determining the density of the material of a body, a student recorded the following observations: (2)
(a) Mass of the body = 60.2 g
(b) Reading of the water level in the measuring cylinder without the body = 15.2 ml
(c) Reading of the water level in the measuring cylinder with the body = 22.2 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 below, what is the measure of the angle of reflection? (2)
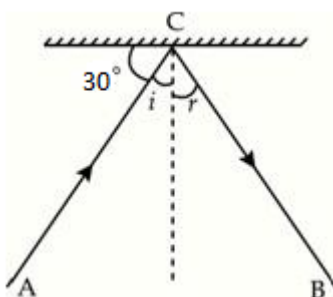
Section A

1. Unwanted plants growing in fields are called weeds. Common weeds are *Amaranthus* and *Chenopodium*.

2. Ammonification is the formation of ammonia or its compounds from nitrogenous compounds (e.g. nitrogen present in dead plant material compounds), especially as a result of bacterial decomposition.
    Nitrification is the process in which ammonium is converted to nitrite and then nitrate. This process naturally occurs in the environment, where it is carried out by specialised bacteria.

Section B

3. <u>Measures to prevent soil erosion:</u>
    (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 = 6 m/s^2
    t = 3 min = 180 s
    To find the distance we use

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

    $$\therefore s = (0).180 + \frac{1}{2}(6).(180)^2$$

    s = 97200 m = 97.2 km.
    Therefore, the distance travelled by this car is 97.2 km.
    Calculating the speed of this car,

    $$\text{Speed} = \frac{\text{Distance}}{\text{time}} = \frac{97200}{180} = 540 \text{ m/s}$$

    The speed of this car is 540 m/s.

    OR

When gravity is acting on a falling object, the equations of motion become:

$v = u + gt$

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

$v^2 = u^2 + 2as$

5. The number of atoms of an element that join to form a molecule of that element is known as its atomicity.

Diatomic molecules: H_2, O_2, N_2, Cl_2

Section C

6. <u>Drawbacks of Rutherford's Model of an Atom:</u>
- 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.
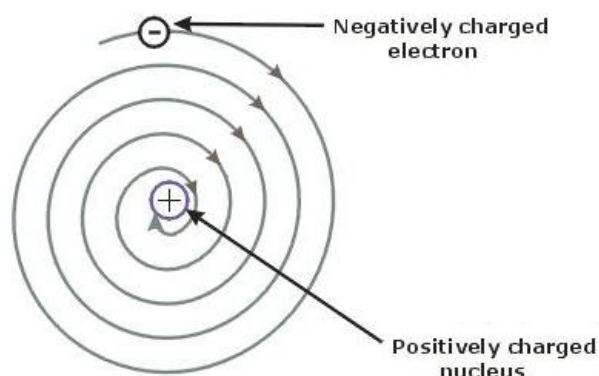
7.

(a) The flower available for the collection of nectar and pollen is known as pasturage or flora.

(i) Quality of honey and taste of honey depend on pasturage.

(ii) Pollen grains serve as protein food for bees.

OR

<u>Effects due to excessive irrigation of crops:</u>
- Soil erosion
- Changes in the composition of soil due to solubilisation of some of the minerals from the soil
- Water pollution

8.

  (a) We would place ice in the water to cool it more quickly because ice takes its latent heat from the water and hence cools it more effectively. On the other hand, if we keep the water on ice, then the latent heat would be taken from the surrounding air, hence releasing its coolness to the surrounding and not the water.

  (b) The latent heat of fusion of ice is 3.34×10^5 J/kg. This means that 3.34×10^5 joules of heat is required to change 1 kg of ice at its melting point of 0^oC into water at the same temperature (of 0^oC). This means that 1 kg of ice at 0^oC has 3.34×10^5 joules of less heat than 1 kg of water at the same temperature of 0^oC.

  (c) 1 kg of steam at 100^oC has more heat than water at the same temperature because when water changes into steam, it absorbs latent heat, but when steam condenses to form water, an equal amount of latent heat is given out.

9.   Distance travelled by the pulse 's' = 10 m

  Time taken 't' = 0.6 s

  Frequency 'ν' = 150 Hz

  (a) We know that

$$v = \frac{\text{distance}}{\text{time}} = \frac{s}{t} = \frac{10}{0.6} = 16.66 \text{ m/s}$$

  Hence, the velocity of the pulse is 16.66 m/s.

  (b) We know that

$$v = \nu\lambda$$

$$\lambda = \frac{v}{\nu} = \frac{16.66}{150} = 0.11 \text{ m}$$

  Hence, the wavelength of the pulse is 0.11 m.

10. a) The bullet imparts an equal and opposite momentum to the gun due to which the gun gives a backward jerk. This backward velocity of the gun is called recoil velocity.

  b) When two bodies act upon one another, their total momentum remains constant provided that no external forces are acting on it.

11. m = 20 kg

  W = m x g = 20 x 9.8 = 196 N

  l x b x h = 70 cm x 60 cm x 50 cm

  Its breadth and height are in contact with the floor.

  Thus, area of that portion = 60 cm x 50 cm = 300 cm^2

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

Area of the surface of the cuboid (A)= b×h

Assuming the surface of 60 cm×50 cm to be in contact with the floor.

$A = 60 \times 50 = 3000 \text{ cm}^2 = 0.3 \text{ m}^2$

$F = W = m \times g = 20 \times 9.8 = 196 \text{ N}$

$\therefore P = \dfrac{196}{0.3} = 653.3 \text{ N/m}^2$

The pressure exerted by the block on the floor is 653.3 N/m².

OR

Work done in moving a body is equal to the product of force and displacement of the body in the direction of force.

The SI unit of work is Joule. Work does not depend on direction; hence, it is a scalar quantity.

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

$$= 32 + 2 \times 16$$

$$= 64 \text{ grams}$$

Now, 64 g of sulphur dioxide = 1 mole

$$\text{So, 32 g of sulphur dioxide} = \frac{1}{64} \times 32 \text{ moles}$$

$$= \frac{1}{2} \text{ moles}$$

1/2 mole of sulphur dioxide will have the same number of molecules as 1/2 mole of oxygen. So, we convert 1/2 mole of oxygen into mass in grams.

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

$$= 2 \times 16$$

$$= 32 \text{ grams}$$
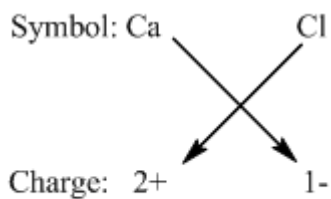
Now, 1 mole of oxygen = 32 grams

$$\text{So, 0.14 mole of oxygen} = 32 \times \frac{1}{2} = 16 \text{ gms}$$

Thus, 16 grams of oxygen will contain the same number of molecules as 32 grams of sulphur dioxide.
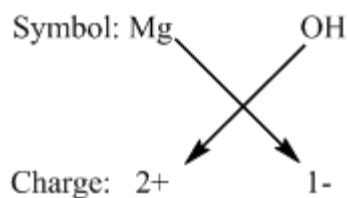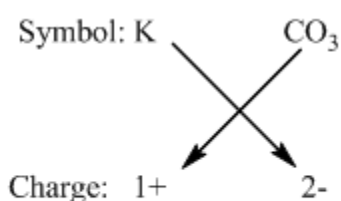
OR

(a) Calcium chloride

Symbol: Ca   Cl

Charge: 2+   1-

Formula: $CaCl_2$

(b) Magnesium hydroxide

Symbol: Mg   OH

Charge: 2+   1-

Formula: $Mg(OH)_2$

(c) Potassium carbonate

Symbol: K CO_3

Charge: 1+   2-

Formula: K_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. Diffusion: It is the movement of substances from a region of higher concentration to a region of lower concentration until they are spread out evenly.
Osmosis: Osmosis is the diffusion of a solvent, usually water, through a semi-permeable membrane from a dilute or weaker solution to a concentrated or stronger solution.
Importance: Diffusion and osmosis are important for the transport of substances across the cell membrane.

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 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

Section D

16.

(a)

    (i) Areolar tissue

    (ii) Ligament

    (iii) Xylem

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

Collenchyma	Parenchyma
Cells are thickened at the corners and contain cellulose, hemicellulose and pectin.	Cells are thin and contain cellulose.
Intercellular spaces are absent.	Cells are either closely packed or have small intercellular spaces.
It gives mechanical support to the growing parts of the plant.	It performs functions such as photosynthesis, storage and secretion.

17. (a)

    Work done by a force is given by

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

    $\theta = 60^\circ$

    $W = 200$ J

    $s = 30$ m

    $\therefore 200 = F \times 30 \, (\cos 60^\circ) = F \times 30 \times \dfrac{1}{2} = F \times 15$

    $\therefore 200 = F \times 15$

    $\therefore F = \dfrac{200}{15} = 13.33$ N

Work = F x s

F = 5000 N

v = 20 m/s

t = 1.5 min = 1.5 x 60 s = 90 seconds

In case of motion, the displacement of a car is given by

$$\text{Velocity } (v) = \frac{\text{Displacement}}{\text{time}}$$

$s = 20 \times 90 = 1800$ m

Thus,

W = 5000 N x 1800 m = 9 x 10^6 J

So, work done by the car to reach the river side is 9 x 10^6 J.

18.

(a) (i) Liquid (ii) Gas (iii) Solid (iv) Plasma (v) Bose–Einstein Condensate (BEC)

(b) Ammonium chloride; Sublimation

(c) Carbon dioxide

(d) Water

(e) D (plasma)

OR

(a) $CuBr_2$

(b) $Al(NO_2)_3$

(c) $Ca_3(PO_4)_2$

(d) $Mg(CH_3COO)_2$

(e) $HgCl_2$

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

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

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

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

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

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

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

$\therefore m_{moon} = 5$ kg

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

(b) We know that

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

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

$$\therefore \text{Dis}\tan\text{ce} = 660 \text{ m}$$

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/s².

(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/s² will require a greater force.

20.
(a) Importance of classification:
    i.   To help in the identification of living organisms as well as to understand the diversity of living organisms.

ii. To understand and study the features, similarities and differences between different living organisms and how they are grouped under different categories.
iii. To understand the inter-relationships among the different groups of organisms.

(b) In Poriferans, the water canal system helps in circulating water for food and oxygen. Poriferans are primarily found in marine habitats.
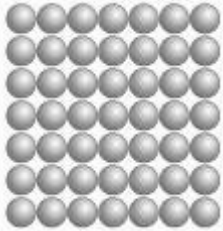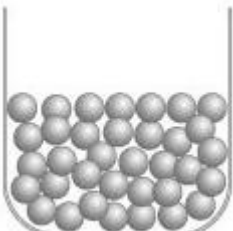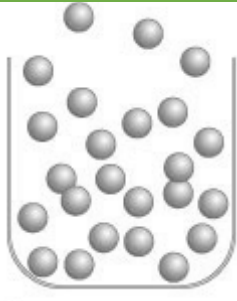
OR

(a) <u>Characteristic features of Protochordates:</u>
(i) They are bag-like, sessile, soft-bodied, non-metameric animals.
(ii) The adult body is covered with a tunic or testa containing cellulose.
(iii) The notochord is present only in the tail or free-living tadpole-like larva.
(iv) The dorsal tubular nerve cord is present in the larval form and it degenerates in the form of small ganglion in adults.

(b)
(i) Frogs live in both water and land. They use their skin to breathe when in water and the lungs to breathe when on land.
(ii)Whale is a warm-blooded animal. It gives birth to young ones and has mammary glands. Therefore, it is considered a mammal.

21.

Solid State	Liquid State	Gaseous State
The space between the particles is very less.	The space between the particles is slightly more as compared to the solids, but still very less as compared to the gases. The particles of liquid can slip and slide over each other.	The particles are much farther apart from one another as compared to solids and liquids. They have a very disorderly arrangement of particles compared to solids and liquids.
The force of attraction between the particles is strong. Thus, particles in a solid are closely packed.	The force of attraction between the particles is strong enough to hold the particles together but not strong enough to hold the particles in a fixed position.	The force of attraction between the particles is negligible; hence, particles of a gas move freely in all the directions. Gases thus can mix or diffuse into other gases.
The kinetic energy of the particles is very less, and so, solids have an orderly arrangement of particles. Therefore, solids have a fixed shape and a fixed volume.	The kinetic energy of the particles is more than that of solids. Thus, liquids have a disorderly arrangement of particles compared to solids.	The particles of a gas have maximum kinetic energy. They move with high speed in all directions and can exert pressure on the walls of its container.
Solids maintain their shape even when they are subjected to external force, i.e. they are rigid.	Liquids do not have a fixed shape but have a fixed volume. Liquids take up the shape of the container in which they are poured.	Gases neither have a definite shape nor a definite volume. They fill up the container completely.
Solids cannot be compressed.	Liquids cannot be compressed much. The compressibility of liquids is almost negligible.	Gases can be compressed easily. Example: LPG cylinders used at home and CNG cylinders used in vehicles

Section E

22. A – Xylem, B – Phloem

    (a) Elements of tissue B (Phloem) – Sieve tube elements, companion cells, phloem parenchyma and phloem fibres

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

<p align="center">OR</p>

    (a) Sclerenchyma tissue

    (b) Sclerenchyma tissue yields jute and coir.

23.

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

   (b) Fern belongs to Division Pteridophyta.

24.

    (i) Ammonium chloride and sand: By sublimation

    (ii) Pigments of leaf: Chromatography

    (iii) Nitrogen from liquid air: By fractional distillation

    (iv) Iodine and chloroform: Distillation

25. Toasting bread is a chemical change. When we supply heat to the bread, the heat cooks it, changing it on a molecular level. As a chemical change cannot be reversed, we cannot change toast into bread.

<p align="center">OR</p>

When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphite is formed.

It is a double displacement reaction.

$$H_2S_{(g)} + CuSO_{4(aq)} \rightarrow CuS\downarrow + H_2SO_4$$
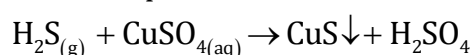
26.

Given : The mass of the body = 60.2 g

Volume of the body = 22.2 -15.2 = 7 mL = 7 cm^3

Density of the material of the body $=\dfrac{Mass}{Volume}=\dfrac{60.2}{7}=8.6 \text{ g}/\text{cm}^3$

$$= \frac{8.6 \times 100 \times 100 \times 100}{1000} = 8600 \text{ kg/m}^3$$

<p align="center">OR</p>

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. $\angle i = 90° - 30° = 60°$
$\angle i = \angle r = 60°$

Hence, the angle of reflection is 60°.