

**Meghalaya Board
Class IX
Science and Technology
Sample Paper 2 – Solution**

SECTION A

PHYSICS

1. In the case of uniform velocity, the speed or direction of a moving object is not changed and thus there is no acceleration. Therefore, in the case of uniform velocity the acceleration will be zero
2. The fan has a tendency to continue its circular motion even after it is switched off due to the inertia of motion. Thus, the fan continues to move for some time even after switching it off.
3. The force between the Earth and the body is known as the force of gravity or gravitational force. It is also called the weight of the body.
4. The energy possessed by a rolling stone is kinetic energy.
5. Factors which affect the value of g : (any two)
 - (i) Shape of the Earth: The Earth is not perfectly spherical. It is slightly flattened at the poles and bulgy towards the equator. The value of g is maximum (9.83 m/s^2) at the poles as the polar radius is minimum, while it is minimum (9.78 m/s^2) at the equator as the equatorial radius is maximum.
 - (ii) Altitude: As the height (h) above the Earth's surface increases, the value of g decreases. It varies by a value of $\frac{1}{(R+h)^2}$, where R is the radius of the Earth.
 - (iii) Depth: In the interior of the Earth, on an average, the value of g is less than that at the Earth's surface. As the depth below the Earth's surface increases, the value of g decreases, and finally, it becomes zero at the centre of the Earth.
6. Here, the speed of sound, $v = 340 \text{ m/s}$; time, $t = 1.5 \text{ s}$
 Since the total distance covered by sound is two times the distance between the gun-man and the cliff d , we have

$$d = \frac{v \times t}{2}$$

$$= \frac{340 \text{ m/s} \times 1.5 \text{ s}}{2}$$

$$\therefore d = 255 \text{ m}$$

7. A flying bird or a flying airplane has kinetic energy as well as potential energy during their course of action. The flying bird and airplane have kinetic energy because they are moving. They have potential energy at any point of time in their flight due to their height above ground at that particular point of time. Thus, a body can have both potential and kinetic energy at the same time.

8. The extension of thread decreases because of buoyancy. Buoyancy acts in upward direction opposite to gravitational pull that causes loss in weight. Hence, the extension decreases.

9.

(i) Net force $F = F_2 - F_1 = 30 - 20 = 10 \text{ N}$

(ii) Net force acts along the direction of F_2 .

(iii) Acceleration $F = ma$

$$\rightarrow a = \frac{10}{10} = 1 \text{ ms}^{-2}$$

10.

(i) The boat floats lower in water, that is, it sinks a little more in water.

(ii) Weight of water displaced by the submerged part of the boat increases.

(iii) Because of the greater weight of water displaced the buoyant force acting on the boat increases. This greater buoyant force enables the extra weight of the man in the boat.

11. Let t_1 be the time taken by stone to reach the water surface in the well and t_2 the time taken by sound of splash to travel upward from water surface in well to outer edge of the well.

Then total time $t = t_1 + t_2 = 3.13 \text{ s}$

Given that the depth of water in well $h = 44.1 \text{ m}$

We assume, buoyancy of water on stone is zero.

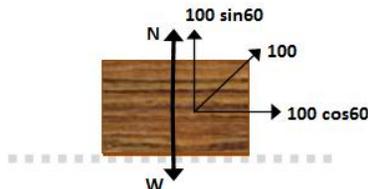
Or

Consider propagation of sound through a medium (say air). When a vibrating object (prong of a tuning fork) moves outward, it pushes and compresses the air in front of it creating a region of high pressure. This region is called a compression. The compression starts to move away from the vibrating object. When the vibrating object moves inwards, it creates a region of low pressure called rarefaction(R). As the vibrating object moves back and forth rapidly, a series of compressions and rarefactions is created in the air. These compressions and rarefactions make the sound wave that propagates through the medium. Compression is the region of high pressure and rarefaction is the region of low pressure. Pressure is related to the number of particles of the medium in a given volume. More density of the

particles in the medium gives more pressure and vice-versa. Thus, propagation of sound may be visualised as propagation of pressure variations or density variations in the medium

12.

(i) Given that a force of 50 N is applied on a box of weight W.



Force applied to the box at an angle of 60 is a vector quantity which has two components—horizontal and vertical.

Because the force causes a displacement in the horizontal direction, its horizontal component is to be considered.

We know that $W = F \cos\theta \times s$

$$\therefore W = 50 \cos 60^\circ \times 6$$

$$\therefore W = 50 \times 0.5 \times 6$$

$$W = 150 \text{ J}$$

(ii) Yes. The two spheres will start rolling in the direction in which the train was moving. Due to the application of the brakes, the train comes to rest, but due to inertia, the spheres try to remain in motion; so, they begin to roll. Because the masses of the spheres are not the same, the inertial forces are also not the same on both. Thus, the spheres will move with different speeds.

Or

Total distance travelled by the train, $d = 10 + 70 + 20 = 100 \text{ km}$

For first 10 km journey:

Speed is 25 km/h

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore 25 = \frac{10}{t_1}$$

$$\therefore t_1 = \frac{10}{25} = 0.4 \text{ h}$$

For second 70 km journey:

Speed is 35 km/h

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore 35 = \frac{70}{t_2}$$

$$\therefore t_2 = \frac{70}{35} = 2 \text{ h}$$

For the final 20 km journey:

Speed is 20 km/h

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore 20 = \frac{20}{t_3}$$

$$\therefore t_3 = \frac{20}{20} = 1 \text{ h}$$

Hence, the total time taken by the train is

$$t = t_1 + t_2 + t_3$$

$$\therefore t = 0.4 + 2 + 1$$

$$\therefore t = 3.4 \text{ h}$$

Therefore, the average speed of the train is

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

$$\therefore v_{av} = \frac{100}{3.4} = 29.1 \text{ km/h}$$

SECTION B CHEMISTRY

- 13.** Different gases give different types of anode rays in the discharge tube experiment because the mass and charge of the anode rays particles depend on the nature of the gas taken in the discharge tube.
- 14.** A molecule consisting of eight atoms is called an octa-atomic molecule (or a poly-atomic molecule). Example: Solid sulphur (S_8) has 8 atoms in its molecule.
- 15.** When a piece of paper is burnt, entirely new substances like carbon dioxide, water vapour, smoke and ash are formed. Hence, burning of paper is a chemical change.

- 16.** Solid carbon dioxide directly changes into carbon dioxide gas and does not melt to produce a liquid (like ordinary ice) hence it is called dry ice. Dry ice is used to deep freeze food and to keep ice creams cold.
- 17.** Common salt, sand, iron filings and sulphur are the substances which do not undergo sublimation.
- 18.** In a pure chemical compound, elements are always present in a definite proportion by mass. For example, in ammonia, nitrogen and hydrogen are always present in the ratio 14:3 by mass, whatever the method or the source from which it is obtained.
- 19.** There are colloidal particles of mist in the forest. When light passes through the canopy of the forest, these colloidal particles are scattered and we observe the Tyndall effect. Smoke and milk also show the Tyndall effect.
- 20.**
- (a) Gram molecular mass of chlorine = $2 \times 35.5 = 71 \text{ g}$
One mole of chlorine will weigh mass = Gram molecular mass = 71 g
- (b) Gram molecular mass of chlorine will contain = 6.022×10^{23} molecules
71 g of chlorine will contain = $\frac{6.022 \times 10^{23}}{71}$ molecules

$$71$$

$$= 8.48 \times 10^{21} \text{ molecules of chlorine}$$

- 21.** 1 mole of Ca = 40 g

$$\begin{aligned} \text{No. of atoms of calcium} &= \text{no. of moles} \times 6.022 \times 10^{23} \\ &= (\text{Given Mass/Molar Mass}) \times 6.022 \times 10^{23} \\ &= (125/40) \times 6.022 \times 10^{23} \\ &= 1.88 \times 10^{24} \text{ atoms} \end{aligned}$$

$$\begin{aligned} \text{No. of atoms of iron} &= (\text{Given Mass/Molar Mass}) \times 6.022 \times 10^{23} \\ &= (130/56) \times 6.022 \times 10^{23} \\ &= 1.39 \times 10^{24} \text{ atoms} \end{aligned}$$

Calcium has more number of atoms.

$$\begin{aligned} \text{Difference in number of atoms} &= 1.88 \times 10^{24} - 1.39 \times 10^{24} \\ &= 10^{24} (1.88 - 1.39) \\ &= 0.49 \times 10^{24} \\ &= 4.9 \times 10^{23} \text{ atoms} \end{aligned}$$

Or

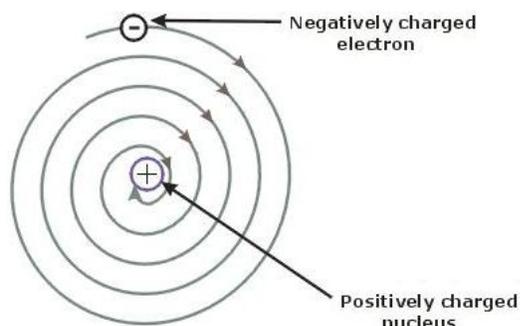
Mass of sodium carbonate + mass of ethanoic acid = mass of sodium ethanoate + mass of water + mass of carbon dioxide

$$5.6 \text{ g} + 7.0 \text{ g} = x + 2.8 + 0.7 \text{ g}$$

$$x = 12.6 - 3.5 = 9.1 \text{ g}$$

22. Drawbacks of Rutherford's Model of an Atom

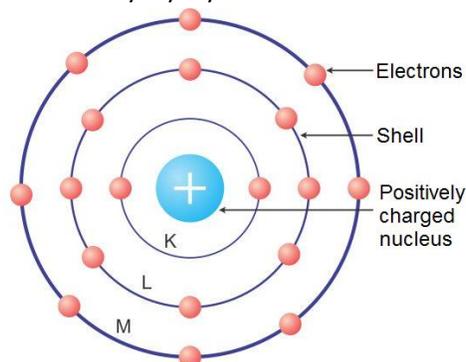
- Rutherford's atomic model could not explain how moving electrons could remain in their orbits.
- Any charged particle during acceleration would radiate energy, and while revolving, it would lose its energy and eventually fall into the nucleus.
- This means that the atom would be highly unstable.
-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



23.

(a) Niels Bohr revised Rutherford's atomic model and put forth the following suggestions:

- Niels Bohr proposed that the electrons possess a specific amount of energy which allows them to revolve around the nucleus.
- An atom contains discrete orbits which correspond to specific amount of energy. Hence, these orbits are also known as energy levels.
- The energy levels of an atom are represented as K, L, M, N and so on or the numbers $n = 1, 2, 3, 4$ and so on.



Niels Bohr's Atomic Model

- The electrons are confined to these energy levels. While revolving in these discrete orbits, the electrons do not radiate energy. Hence, these orbits are also known as stationary orbits or stationary shells. Smaller the size of the orbit, smaller is its energy.
- As we move away from the nucleus, the energy of the orbit increases progressively.

- The transfer of an electron from one orbit to another is always accompanied with the absorption or emission of energy.
- When an electron jumps from a lower energy level to a higher energy level, it absorbs energy.
- When an electron returns from a higher energy level to a lower energy level, it emits energy.

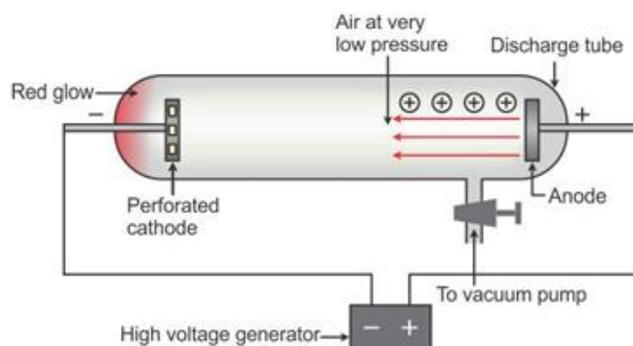
(b) Failures of Thomson's atomic model

- Although Thomson's atomic model explained why an atom is electrically neutral, it could not explain the distribution of electrons in the atom.
- If we accept that electrons are embedded in the positive charge, then the opposite electric charges should cancel each other out and the charged sphere would become chargeless.
- Thomson's model could not explain why different elements have different chemical properties.

Or

Discovery of the Proton

- A German scientist, E. Goldstein in 1886, modified the discharge tube and passed an electric current through it.
- He found that the positively charged rays were emitted from the anode in the discharge tube. These rays were called canal rays.
- When an electric field was applied, these rays deflected towards the negatively charged plate. Thus, Goldstein concluded that an atom contains positively charged particles along with the electrons.
- These positively charged particles were named as protons by a British scientist, Ernest Rutherford.
- Canal rays were also called anode rays since they were emitted from anode (electrode connected to the positive terminal of high voltage source) in the gas discharge experiments using a perforated cathode.



Production of anode rays
Anode Rays Discharge Tube

SECTION C
BIOLOGY

- 24.** *Psudomonas*
- 25.** Fumigation is the most effective method for destroying insects in stored grains
- 26.** The cell organelles plastids and mitochondria have their own genetic material.
- 27.** In hydrophytes (aquatic plants), large air cavities are present in parenchyma to give buoyancy to the plants
- 28.**
- (a) Pear consists of sclereids or stone cells.
 - (b) They form the gritty part of most ripe fruits and contribute hardness to the seed coat and nutshell.
 - (c) Therefore, when we chew a pear, we get a crunchy and granular feeling due to the presence of sclereids.
- 29.** When the biotic components such as plants and animals interact with the abiotic components such as soil and water of the biosphere, constant transfer of food and energy takes place. The flow of energy is unidirectional but the flow of nutrients is cyclic.
- 30.** Immunization is the production of immunity in an individual by artificial means. The diseases against which vaccines are available are - Tuberculosis and Polio.
- 31.** The primitive plants in which plant body is not differentiated into roots, stems and leaves, but is in the form of an undivided thallus are considered Thallophytes.
- 32.** The two main components of blood are plasma and blood corpuscles. Blood is considered as a type of connective tissue because the blood has a fluid matrix i.e. plasma in which blood cells are suspended which flows between different organs of the body.

33.

- (a) Arthropoda: Jointed legs or appendages
- (b) Annelida: Metamerically segmented body
- (c) Porifera: Body perforated with numerous pores

Or

Differences between amphibians and reptiles:

Amphibians	Reptiles
1. Skin is glandular, smooth and moist	1. Skin is non-glandular, dry and keratinised
2. Three-chambered heart	2. Incompletely four-chambered heart
3. Fertilisation is external	3. Fertilisation is internal
4. Examples: Frog, toad	4. Examples: Snake, lizard

34. Advantages of mixed cropping:

- (a) Risk of total crop failure due to an uncertain monsoon is reduced.
- (b) Yield of crops is increased due to the complementary effect of component crops.
- (c) Fertility of the soil is improved by growing two crops simultaneously.
- (d) Chances of pest infection are greatly reduced.

Disadvantages of mixed cropping:

- (a) There is a difficulty in fertiliser application and spraying of pesticides to individual crops.
- (b) Separate harvesting and threshing of crops is not possible.
- (c) Marketing and consumption of only mixed produce are possible

35.

- (a) Whales and fish are aquatic animals and belong to Phylum Chordata. However, they both differ in several basic characters.
- (b) Whales are warm-blooded, while fish are cold-blooded animals.
- (c) Whales respire through the lungs, while fish breathe through gills.
- (d) Whales possess mammary glands which are absent in fish.
- (e) Whales have a four-chambered heart, while fish have a two-chambered heart.
- (f) Therefore, although whales and fish resemble each other and can swim in water, whales cannot be grouped with fish.
- (g) Whales belong to Class Mammalia, while fish are included in Class Pisces.

36.

- (a)
 - (i) Liver
 - (ii) Antibiotics block the chemical pathways of bacteria such as synthesis of cell wall and proteins, thereby killing the bacteria.
 - (iii) No, antibiotics will not help in curing Kiran's disease because hepatitis is a viral disease, while antibiotics are effective against bacteria.
- (b) There are several limitations confronted while treating an infectious disease.
 - (i) When a person gets a disease, the body functions get disturbed and may never recover completely.
 - (ii) Treatment of a disease takes time.
 - (iii) A person suffering from an infectious disease can serve as a medium for further spread of infections to other people.
Therefore, prevention of a disease is more desirable than its treatment.