

**Goa Board**  
**Class IX Science**  
**Term 2**  
**Sample Paper – 9 Solution**

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**SECTION A**

1. The kinetic energy will become 4 times.
2. The atomic number of sulphur is 16. Electronic distribution in the shells will be: K shell = 2, L shell = 8, L shell = 6. Electronic configuration will be (2, 8, 6).
3. The addition of undesirable substances like fertilizers, pesticides and mercury salts contaminate water which can cause diseases like cholera.
4.
  - (a) The cutting edge of a knife should be as sharp as possible so that the (relatively lesser) force applied over the smaller area of the object produces a greater pressure. Due to this, the cutting action is sharp and quick.
  - (b) The density of sea water is more due to its salty nature. Hence, the upthrust acting on the swimmer is more in case of sea water. Thus, it is easier to swim in sea water than in river water.
5. Each and every organism is given a biological name, which consists of two components, one is the genus name, and the other is the species name.
6. Gram molecular mass of  $\text{CO}_2 = 44 \text{ g}$   
i.e. 1 g molecule of  $\text{CO}_2$  has mass = 44 g  
So, 0.72 g molecule of  $\text{CO}_2$  will have mass =  $44 \times 0.72 \text{ g}$   
 $= 31.68 \text{ g}$
7.
  - (a) It is interesting to note that some forms of life, especially, bacteria are poisoned by element oxygen. Also, the process of fixation of nitrogen by bacteria does not take place in the presence of oxygen.
  - (b) Rainfall patterns are decided by the prevailing wind patterns.

8.

(a) Conditions necessary for work to be done:

- A force should be applied to the body.
- The body should be displaced in the direction of the applied force.

(b) A stone lying on the roof of a building has potential energy due to its position above the ground. When the stone is lifted up, work has to be done on it against the force of gravity which is stored in it in form of potential energy. When the stone is allowed to fall freely to the ground, it has the capacity to do an equal amount of work.

9.

(a) The speed of light is  $3 \times 10^8$  m/s while that of sound is 330 m/s in air. So, the speed of light is more as compared to that of sound. Thus, due to the very high speed of light, the flash of lightning is seen before the sound of thunder is heard.

(b) Material medium is required for propagation of sound. On Moon, there is no material medium, that is, there is vacuum. Therefore, sound cannot propagate on Moon. Thus, astronauts cannot hear each other on the Moon.

(c) Steel. This is because steel is more elastic than the other two mediums.

10.

(a) Infrasound: Sound waves of frequencies lower than 20 Hz.

Ultrasound: Sound waves of frequencies higher than 20,000 Hz.

(b) SONAR is a device used to locate the depth of the sea bed or locate underwater things and enemy submarines.

(c) The time taken by the ultrasonic sound to travel from the cliff to the ship is half the time taken by the total time, that is,

$$t = \frac{1.02}{2} = 0.51 \text{ s}$$

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

$$\text{So, Distance} = 1531 \text{ m/s} \times 0.51 \text{ s} = 780.81 \text{ m}$$

11.

(a) Asif explained that the energy required in both cases is equal because whenever the work is done against gravity, the amount of work is equal to the product of weight of the body and the vertical distance through which the body is lifted.

(Work done in lifting a body = weight of body  $\times$  vertical height)

(b) Asif has problem solving and conceptual values.

12.

- (a) In a sound wave, the particles of medium vibrate along the direction of motion of the wave. Thus, the sound wave is known as a longitudinal wave.
- (b) We know that sounds of all frequencies cannot be heard by human ears. The frequency of the vibrating pendulum does not lie within this audible range (20Hz to 20,000Hz) and so, it does not produce an audible sound. Hence, we cannot hear the vibrations produced by a vibrating pendulum.

13.

(a)

Molar mass of  $S_8 = 256 \text{ g/mol}$

We know that,

1 mole of  $S_8 = \text{Molar mass of } S_8 = 6.022 \times 10^{23} \text{ molecules}$

$\therefore 256 \text{ g of } S_8 = 6.022 \times 10^{23} \text{ molecules}$

$$\therefore 16 \text{ g of } S_8 = \frac{6.022 \times 10^{23} \times 16 \text{ molecules}}{256}$$

$$= 3.76 \times 10^{22}$$

Therefore, 16g of  $S_8$  contains  $3.76 \times 10^{22}$  molecules.

(b)

$$\begin{aligned} \text{Molar mass of water (H}_2\text{O)} &= (2 \times \text{Atomic mass of H}) + (1 \times \text{Atomic mass of O}) \\ &= (2 \times 1) + 16 \\ &= 18 \text{ g} \end{aligned}$$

$\therefore 18 \text{ g of water} = 1 \text{ mole}$

$$\therefore 20 \text{ g of water} = \frac{20}{18} = 1.11 \text{ mole}$$

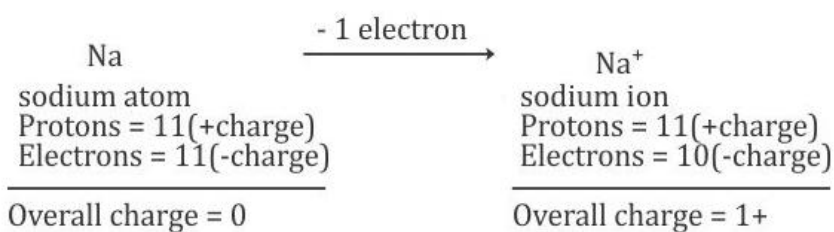
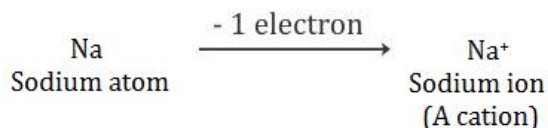
14.

- They have unicellular level of organisation.
- They are mostly aquatic (freshwater or marine).
- They can be solitary, colonial, free-living, parasitic or symbiotic.
- Their body shape can be irregular, spherical, oval, elongated or flattened.
- Cytoplasm is differentiated into ectoplasm (outer) and endoplasm (inner).
- Mode of locomotion can be pseudopodia, flagella or cilia.

15.

- (a) An electron has unit negative charge whereas a proton has a unit positive charge. Both these charges are equal in magnitude. Therefore, the atom as a whole is electrically neutral and will not carry any charge.
- (b) On losing one or more electrons, an atom acquires a positive charge and is called a cation.

Example: Sodium ion ( $\text{Na}^+$ )



- (c) Number of Protons = 4  
Therefore, Atomic number = 4  
Number of Neutrons = 3  
Mass Number = Number of Protons + Number of Neutrons  
= 4 + 3  
∴ Mass number = 7

16.

- (a) The pollutants which decompose and do not cause much harm because they are rendered harmless by natural biological agents are called biodegradable pollutants. The pollutants that remain as such for a long time are called non-biodegradable pollutants.
- (b) The life supporting zone of the earth where the atmosphere, the hydrosphere and the lithosphere interact and make life possible is known as biosphere.

17.

Bryophyta	Pteridophyta
(a) Plant body is gametophyte.	(a) Plant body is sporophyte.
(b) True root, stem and leaves are not present.	(b) True root, stem and leaves are present.
(c) True vascular system is absent.	(c) True vascular system is present.

18. The common symptoms of anaemia are-

- Pale look.
- Tiredness in body.
- Weight loss.
- Loss of appetite.

Anaemia is caused due to the deficiency of mineral iron in the diet.

19.

(a) The general ways of preventing infections:

For airborne diseases: We can prevent exposure by providing living conditions that are not overcrowded.

For waterborne diseases: We can prevent exposure by providing safe drinking water.

For vector borne infections: By providing clean environment which will not allow mosquitoes to breed.

(Any two points)

(b) A person is most likely to fall sick under condition mentioned at (iii).

Reason:

After recovering from malaria she is on a four day fast. Fasting weakens the body's immune system and she is likely to get chicken pox as chicken pox is a contagious disease which spreads through direct contact with the patient.

20.

(a) Since the iron object penetrates more in sand as compared to the wooden object, more work is done by the iron object. Also, the potential energy of an object is equal to the work done by the object. Hence, the potential energy of the iron object is more than the potential energy of the wooden object.

(b) 1 joule of work is done when a force of 1 newton moves a body through a distance of 1 metre in its own direction. That is,

$$1 \text{ joule} = 1 \text{ newton} \times 1 \text{ metre}$$

(c) Team A does positive work. The displacement is in the direction of the force.

Team B does negative work. The displacement is in the direction opposite to the force.

21.

- (a) The relative density of a substance is the ratio of its density to the density of water.  
That is,

$$\text{Relative density} = \frac{\text{Density of the substance}}{\text{Density of water}}$$

Since, it is the ratio of two similar quantities, it has no units.

$$\begin{aligned} 1 \text{ kg / m}^3 &= 1000 \text{ g / (100 cm)}^3 \\ &= 1000 \text{ g / (10)}^6 \text{ cm}^3 \end{aligned}$$

$$\text{Or, } 1 \text{ kg / m}^3 = 10^{-3} \text{ g / cm}^3$$

- (b) Given that: Mass of the object = 75 g, Volume of object = 30 cm<sup>3</sup>

We know that,

$$\text{Density} = \frac{\text{Mass of the object}}{\text{Volume of the object}}$$

Substituting the values, we get :

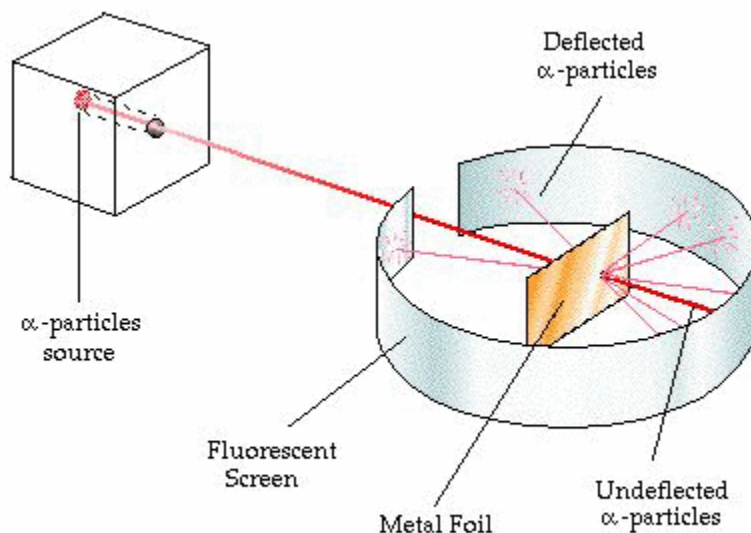
$$\text{Density} = \frac{75 \text{ g}}{30 \text{ cm}^3} = 2.5 \text{ g cm}^{-3}$$

Since the density of the object is lesser than the density of water (1 g/cm<sup>3</sup>), the wooden block will sink in the water.

22. In 1911, Earnest Rutherford, a scientist from New Zealand, overturned Thomson's atomic model by his gold foil experiment. His experiment demonstrated that the atom has a tiny massive nucleus. It thus rejected Thomson's model of the atom.

#### **Rutherford's Scattering Experiment**

- Rutherford selected a gold foil as he wanted a very thin layer.
- The gold foil used by Rutherford was 0.004 millimetres in thickness. That is, the foil was about 1000 atoms thick.
- In his experiment, fast moving Alpha particles ( $\alpha$ -particles) were made to fall on a thin gold foil.
- Alpha particles are helium ions with +2 charge. Their atomic mass is 4 u, hence, a high velocity beam of  $\alpha$ -particles has a lot of energy.
- These particles were studied by the means of flashes of light which they produced on striking a zinc sulphide screen.
- The  $\alpha$ -particles are much heavier than the sub-atomic particles present in the gold atoms.
- Hence, he expected the  $\alpha$ -particles to pass through the gold foil with little deflection and strike the fluorescent screen.

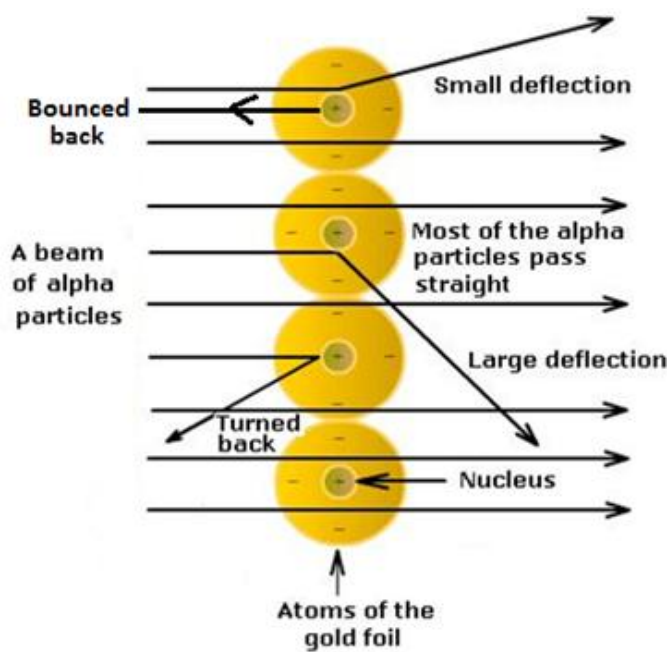


### Rutherford's $\alpha$ -Particle Scattering Experiment

But the observations he made were quite unexpected.

#### Observations made by Rutherford:

- Rutherford observed that most of the  $\alpha$ -particles passed straight through the gold foil.
- Some  $\alpha$ -particles were deflected by the foil through small angles while some were deflected through very large angles.
- One out of every 12000 particles was deflected through  $180^\circ$  showing a full rebound.



Deflection of  $\alpha$ -Particles from the Gold foil

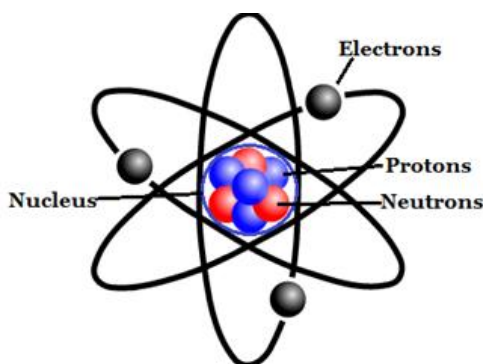
Rutherford said that, "This result was almost as incredible as if you fire a 15-inch shell at a piece of tissue paper and it comes back and hits you".

### Explanation of the results of Rutherford's Gold foil experiment

- Rutherford postulated that the atom must contain large empty spaces as most of the  $\alpha$ -particles passed through it without getting deflected.
- The  $\alpha$ -particles, being positively charged, could only be deflected by positive charges present inside the atom.
- As very few  $\alpha$ -particles were deflected, Rutherford concluded that the positively charged particles in an atom must be concentrated in a very small space.
- An even smaller fraction of  $\alpha$ -particles were deflected through an angle of  $180^\circ$ .
- Thus, Rutherford came to the conclusion that all the positive charge of the atom and most of the mass of the atom is concentrated in a very small volume within the atom.
- Rutherford named this small space inside the atom as the "nucleus of the atom" or the "atomic nucleus". When the thickness of the gold foil was doubled, the number of  $\alpha$ -particles reflecting back was also doubled.
- On the basis of these observations, Rutherford calculated that the atomic nucleus is  $10^5$  times smaller than the total area of the atom.
- The radius of an atom is  $10^{-8}$  centimetre while the radius of the nucleus is  $10^{-13}$  centimetre.
- Thus, we can say that the atom is relatively hollow with a heavy nucleus at its centre. The electrons arranged around the nucleus possess negligible mass.
- Based on his observations, he formulated his '**Theory of atom**'.

### Rutherford's Atomic Model

- Based on the results of the  $\alpha$ -particles scattering experiments, Rutherford put forth his atomic model.
- An atom contains a positively charged centre called the nucleus of the atom. Almost all the mass of the atom is concentrated in the nucleus.
- Electrons of the atom revolve around the nucleus in fixed, circular orbits.
- The size of the nucleus is many times smaller than the size of the atom. The nucleus of an atom is 10,000 times smaller than that of the atom.
- If we consider that an atom is equal to the size of a football stadium, then the nucleus would be the size of a pea!!



Rutherford's Atomic Model



**23.**

(a) Nitrogen fixation involves the following three steps:

- Conversion of atmospheric nitrogen into nitrates and nitrites by nitrogen fixing bacteria which are found in the roots of legumes or during lightning in the sky.
- Formation of proteins by plants and animals from nitrates.
- On decay and death of plants and animals, denitrifying bacteria convert the nitrates back to elemental nitrogen.

(b) As a consequence of population explosion, we need more food, clothing, shelter and other resources. In order to meet the increasing demand of food, more grains, vegetables and fruits etc. are to be grown by using fertilizers and pesticides. For providing shelter and clothes, forests are cut to build houses and establish industries. All this leads to ecological imbalance and becomes a big cause of pollution.

(c) Forests help in maintaining carbon dioxide and oxygen ratio in the atmosphere. For, they inhale carbon dioxide and exhale oxygen which enhances the quality of air by increasing oxygen content.

The roots of plants bind the soil firmly and hence help in controlling soil erosion. Forests regulate water cycle and Earth's temperature. Forests cause more rains which helpful in reducing the shortage of water.

**24.**

(a)

- Their body is streamlined to reduce air resistance.
- They have well developed flight muscles.
- Their forelimbs are modified into wings.

(b)

- i. Class Pisces.
- ii. Class Reptilia.

(c) There are a very large number of organisms and it is very difficult to study them individually; so, classification enables us to deal with enormous diversity of life in an arranged manner.

**SECTION B**

**25.(b)**

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{5 \times (8 \times 2)}{10} = 8 \text{ m/s}$$

**26.(b)**

Hollow cardboard tubes prevent the loss of sound. They prevent spreading of sound by having multiple reflections.

**27.(a)**

This is because salt water is the densest among all the liquids. More the density of the liquid, more is the upthrust and more is the loss in weight.

**28.(d)**

Due to the presence of anal tail, they are classified under the same phylum.

**29.(c)**

Outer cell wall of spirogyra is made up of pectin.

**30.(c)**

$$\angle i = 90^\circ - 60^\circ = 30^\circ$$

$$\angle i = \angle r = 30^\circ$$

**31.(a)**

Volume of displaced liquid = volume of the body immersed in the liquid

**32.(b)**

$$\text{KE} = \frac{1}{2}mv^2$$

$$\text{If } v \text{ becomes } 2v, \text{ then } \text{KE} = \frac{1}{2}m(2v)^2 = 4\left(\frac{1}{2}mv^2\right) = 4 \text{ times initial KE}$$

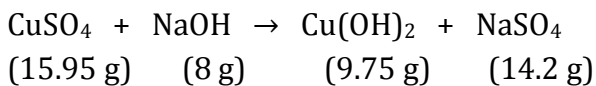
**33.(a)**

Substances involved in a chemical reaction can change their state but the total mass of the product will be equal to that of the product.

**34.(b)**

In Spirogyra, the chloroplasts are spiral and ribbon like structures. The nucleus is suspended in the centre by cytoplasmic strands. The cytoplasm is scattered in the entire cell. The cell wall is the outermost layer of the cell.

35. Copper sulphate reacts with sodium hydroxide to form a blue precipitate of copper hydroxide and sodium sulphate.



From the given data, we get,

$$\text{Total mass of reactants} = (15.95 \text{ g} + 8 \text{ g}) = 23.95 \text{ g}$$

$$\text{Total mass of products} = (9.75 \text{ g} + 14.2 \text{ g}) = 23.95 \text{ g}$$

Therefore, the total mass of the reactants is equal to the total mass of the products.

Hence, the law of conservation of mass is valid.

36.

- (a) Work is being done. Force is applied by the girl on the trolley, due to which the trolley moves.
- (b) Work is not done. Since, Suhan is standing so there is no change in his position.
- (c) Work is being done. This is because Ankur is moving himself in the pool by applying force due to which his position is changing.
- (d) Work is being done. Force is applied on the pebble by the boy using his foot. Due to this, the pebble moves through a certain distance.