Goa Board
Class IX Science
Term 2
Sample Paper – 4 Solution

SECTION A

1. A blacksmith raises the hammer to a height before striking the chisel so that, the hammer has a higher amount of potential energy and hence, more work can be done on the chisel.

2. Two examples of polyatomic ions are NO_3^- and SO_4^{2-}.

3. A Communicable disease is defined as a disease which is transmitted through direct contact with an infected individual or indirectly through a vector.

4. Given:

$m = 40$ kg; $v = 3$ m/s; $t = 1$ s

Kinetic energy is

$$K.E. = \frac{1}{2}mv^2 = \frac{1}{2} \times 40 \times 3^2$$

$$K.E. = 180 \text{ J}$$

Now, power is given as

$$P = \frac{E}{t} = \frac{K.E.}{t} = \frac{180}{1} = 180 \text{ W}$$

5.

(a) Differences between gymnosperm and angiosperm.

Angiosperm	Gymnosperm
(i) Seeds are enclosed within the fruit.	(i) Seeds are naked and are not enclosed within a fruit.
(ii) The plants bears flowers.	(ii) The plants bear cones.

(b) Arthropoda.

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

- Rutherford's atomic model could not explain how the moving electrons could remain in their orbits.
- Any charged particle during acceleration would give out energy; and while revolving it would lose 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.

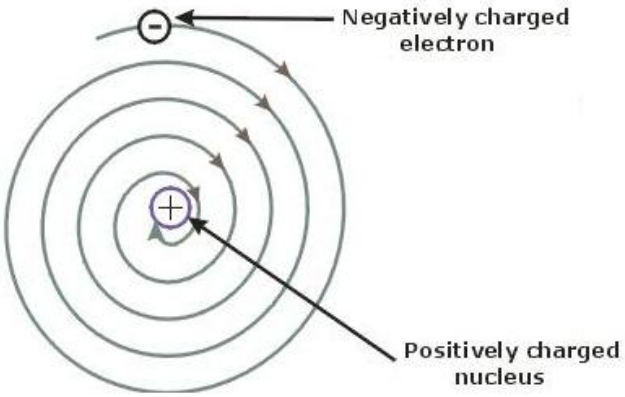
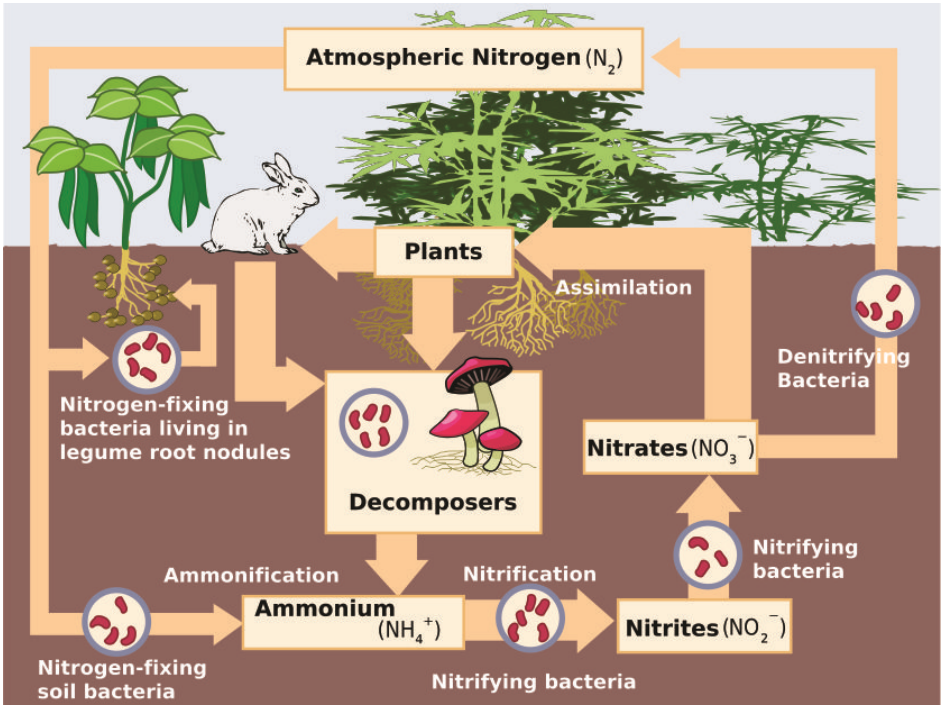


Diagram Showing the Atom Losing Energy

7.



Nitrogen cycle

8.

(a)

Longitudinal waves	Transverse waves
Longitudinal waves are the waves in which medium particles vibrate in a straight line parallel to the direction of wave propagation.	Transverse waves are the waves in which medium particles vibrate at right angles to the direction of wave propagation.
In a longitudinal wave, alternate compressions and rarefactions are formed.	In a transverse wave, alternate crests and troughs are formed.
Example: Sound waves	Example: Light waves

(b) The two important applications of ultrasound waves are:

i. They are used to detect abnormalities in certain human organs such as detection of stone in gall bladder and kidney or detection of tumours in different human organs.

ii. They are used for a thorough cleaning of objects like spiral tubes, odd shaped parts, electronic components etc.

9.

(a) Soil erosion is the gradual wearing away of land by water, wind and general weather conditions.

(b) Soil is formed by the following two processes:

i. **Weathering:** It is the process of breaking down of rock from the sediment. It includes physical, chemical and biological processes.
Physical processes are temperature, wind, rain, water, ice, snow and glaciers.
Chemical processes include hydrolysis, hydration, oxidation and reduction.
Biological processes include production of organic acids by lichens and mosses which lead to the breakdown of rocks into smaller particles.

ii. **Paedogenesis:** In this phase of soil formation, soil gets enriched with minerals and humus by the action of detritivores and arthropods. The addition of organic matter is the final stage in soil formation.

10.

(a) Potential energy possessed by an object is the energy present in it by virtue of its position or configuration (i.e. size and shape) or change.
Example - Water stored in a dam, a stretched or compressed spring, stretched bow and arrow, an object situated at a height possesses potential energy.

(b) The gravitational potential energy of an object at a point above the ground is defined as the work done in raising it from the ground to that point against gravity.
If an object of mass 'm' is situated at a height 'h' above the ground, then its gravitational potential energy is given by $E_P = mgh$.

Change in the potential energy between two given points simply depends upon the difference in the vertical heights of the initial and final positions of the object and not on the path along which the object is moved.

11.

(a) Speed of ultrasound through sea water is $v = 1530\ ms^{-1}$
Time of echo is $t = 3.42\ s$
So, the depth of the sea bed is

$$d = \frac{vt}{2}$$
$$= \frac{1530 \times 3.42}{2}$$
$$= 2616.3\ m$$

(b) SONAR stands for sound navigation and ranging. It is a device which uses ultrasonic waves to measure the distance, direction and speed of underwater objects.

12. 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.
The relation between joule and erg is:
$1\ J = 1\ N \times 1\ m$
Now, $1\ N = 10^5$ dyne
$1\ J = 10^5\ dyne \times 10^2\ cm$
$1\ J = 10^7\ dyne \times cm = 10^7\ erg$
$1\ J = 10^7\ erg$

13. 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.

14.

i. Mole is the amount of substance which contains the same number of particles (atoms/ions/molecules/formula units etc.); this was the concept understood by Rekha.

ii. Avogadro's constant is the number of particles present in exactly 12 g of Carbon-12. It is equal to 6.022×10^{23}.

iii. **Formula Unit Mass**

a. The formula unit mass of a substance is a sum of the atomic masses of all the atoms in a formula unit of a compound. Formula unit mass is calculated in the same manner as we calculate the molecular mass. The only difference is that we use the term 'formula unit' for those substances whose constituent particles are **ions**.

15. The ratio of molecules in sulphur dioxide and methane will be the same as the ratio of their moles.

The molecular formula of sulphur dioxide is SO_2.

So, 1 mole of SO_2 = Mass of S + Mass of 2 'O'

= 323 + 2 ×16

= 64 grams

Now, 64 g of sulphur dioxide = 1 mole

So, 1 g of sulphur dioxide = $\frac{1}{64}$ mole

Thus, we have $\frac{1}{64}$ mole of sulphur dioxide and it contains x molecules in it. Since equal moles of all the substances contain equal number of molecules, $\frac{1}{64}$ mole of methane will also contain x molecules of methane.

Molecular formula of methane is CH_4.

So, 1 mole of CH_4 = Mass of C + Mass of 4 H

$= 12 + 4 \times 1$

= 16 grams

Now, 16 g of methane = 1 mole

We know that $\frac{1}{64}$ mole of methane contains x molecules

Therefore, $\frac{1}{16}$ mole of methane will contain: $\frac{x \times 64}{16}$ molecules

= 4 x molecules

Thus, if 1 g of suphur dioxide contains x molecules, then 1 g of methane contains 4x molecules.

16.

(a)

i. Due to binomial nomenclature, every living organism has a distinct and unique scientific name. This helps in easy identification and classification of organisms.

ii. An organism can be identified by its scientific name in any part of the world. There is no confusion due to differences in languages, since binomial nomenclature uses Latin names.

(b) Amphibians are cold blooded animals having three chambered heart whereas Aves are warm blooded animals having four chambered heart.

17.

(a) Following are the causes of non-infectious diseases:

i. Deficiency of certain essential substances in our diet.

ii. Degeneration and wearing out of tissues.

iii. Uncontrolled proliferation of tissues in any part of the body.

iv. Defects in metabolic pathways.

v. Damage and injuries of tissues and body parts by accident.

(b)

i. Mycobacterium tuberculosis.

ii. Hepatitis B virus.

iii. Plasmodium sp.

iv. Polio virus.

18. Ans18. Members of Phylum Echinodermata have the following features:

i. They are triploblastic, coelomates, unsegmented and show pentamerous symmetry in adults.

ii. Their body is without a head, but has oral and aboral surfaces.

iii. They are characterised by the presence of a water-vascular system which extends from the body surface as a series of tentacle-like projections.

iv. Digestive system is usually complete, but excretory organs are absent.

v. Sexes are separate and fertilization is usually external.

19.

(a) A person is most likely to fall sick under condition 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.

(b) Viruses have different cell pathways as compared to bacteria. Thus, they cannot be killed by antibiotics.

Viruses have few biochemical mechanisms of their own. They enter the host cell and use their machinery for their life processes.

If we have to reduce the severity of the disease then we have to work against our body or the host cell.

20.

(a)

i. In case of an electron revolving in a circular orbit of radius 'r' around a nucleus, centripetal force provided by the electrostatic force of attraction acts on the electron towards the centre but the motion is along the tangent to the circular orbit at each point. As force and displacement are mutually perpendicular to each other, the work done is zero.

ii. In case of an electron moving with half the speed of light free of all forces, work done will be zero as there is no force acting on the electron.

(b) Height of the overhead tank 'h' = 20 m

Mass of the water to be raised 'm' = 2000 kg

Time 't' = 15 min = $15 \times 60 = 900$ s

$$\text{Power of the pump} = \frac{\text{Total work}}{\text{Total time}} = \frac{mgh}{t} = \frac{2000 \times 9.8 \times 20}{900} = 435.5 \text{ W}$$

(c) The instantaneous power of a device at a particular instant of time is defined as the rate of doing work by the device at that very instant.

21. There are three characteristics of sound, viz.

i. Loudness
ii. Pitch
iii. Quality or Timbre

Explanations:

i. **Loudness**: The sensation of hearing which enables us to distinguish between a loud sound and a soft sound is called loudness. It basically depends on the amplitude. The amplitude of the sound wave depends upon the force with which an object is made to vibrate. Loud sound can travel a greater distance as it is associated with higher energy. As a sound wave moves away from its source, its amplitude as well as its loudness decrease. The loudness of the sound is also related to the intensity of the sound.

ii. **Pitch**: Pitch is the characteristic of the sound which distinguishes a sharp sound from a dull sound of the same loudness. As the vibrations of the source become faster, the frequency will also become higher and so, the higher will be the pitch. Therefore, a high pitch sound corresponds to more number of compressions and rarefactions passing a fixed point per unit time. Pitch increases with an increase in the frequency of the sound. A low pitched sound could have the same loudness as pitch is independent of amplitude.

iii. **Quality or Timbre**: It is the characteristic of musical sound which distinguishes one sound from the other when both have the same loudness and the same pitch. The sound which is more pleasant to our ears is said to be of good quality. Two different musical instruments can be differentiated by their quality of sound.

22.

(a) Valency is the combining capacity of an atom. Valency is calculated by using number of valence electrons present in an atom.

The number of electrons present in the last shell of an atom and take part in chemical bond formation is known as valence electrons.

The number of electrons which an atom has in its last orbit can be found out by writing the electronic configuration of an atom.

Thus, electronic configuration expresses the valence electrons which are related to the valency of an atom.

(b) Mass number = Number of protons + Number of neutrons

Hence, mass number of A = 6 + 6 = 12

Mass number of B = 6 + 8 = 14

The two atomic species have the same number of protons but different number of neutrons. In other words, the two species have the same atomic number but different mass number. Such atoms are called isotopes.

The atoms A and B represent the same element i.e. carbon with atomic number 6.

23.

(a) "Urbanisation and industrialisation are mainly responsible for the increase in environmental pollution"

This is due to the following reasons:

i. Increased consumption of fossil fuels has increased the production of pollutants like CO_2, SO_2, NO_2, CO_2 etc.

ii. Release of CFC molecules in the atmosphere has led to depletion of the ozone layer which results in the entry of UV rays into the Earth's atmosphere.

iii. Oxides of sulphur and nitrogen dissolve in rain water to produce acid rain.

(b) Measures to check environmental pollution:

i. Reducing consumption of fossil fuels.

ii. Planting more trees.

iii. Usage of non-conventional sources of energy. Example - solar, wind, tidal energy.

24.

(a) Differences between bony and cartilaginous fish:

Bony Fish	Cartilaginous fish
(i) Bony fish are found in fresh water as well as in sea water.	(i) They are mostly marine.
(ii) Mouth is terminal in position.	(ii) Mouth is usually ventral.
(iii) Endoskeleton consists of bones.	(iii) Endoskeleton consists of cartilage.

(b) Animals whose body temperature does not remain constant but varies along with atmospheric temperature are called cold blooded animals.

(c) Excretory organs of the following animals:

i. Sponges: General body surface.

ii. Annelids: Nephridia.

SECTION B

25. (a) The angle between two pipes is 2θ.
For perfect reflection, angle of incidence = angle of reflection

26. (b) B.
The spring balance B measures the mass correctly up to one decimal place.

27. (b) The density of the object is 4g/cm3.
Loss of weight = Weight of liquid displaced
35 × g = volume of the water displaced × density of water × g
35 × g = volume of the object ×1× g
volume of the object = 35 cm^3

$$\text{Density of the object} = \frac{\text{mass}}{\text{volume}} = \frac{140}{35} = 4\ g/cm^3$$

28. (d) Heavier than water and insoluble in it
It should be heavier than water and insoluble in it; so that, it sinks and displaces the water and also, it does not mix in the water.

29. (d) Equal in all three vessels
Apparent weight depends on the density of the fluid. In all the three cases, the fluid is the same, so, the solid will weigh the same in all of them, but the weight will be less than that in the air.

30. (d) Steel
Sound travels fastest in solids.

31. (c) Respiration
Spiracles are small openings that are present on the surface of the cockroach's body, which help in the process of respiration.

32. (a) Barium chloride
Barium chloride is used in the experiment to verify the law of conservation of mass along with sodium sulphate.

33. (a) Jellyfish
Jellyfish is diploblastic.

34.

(a) The sound will be less loud.

(b) If we cover the reflecting surface with a curtain, then the reflected sound will partly get absorbed and partly get reflected. The amount of absorption depends on the material of the curtain.

35. Let us consider an example of ice. When ice melts into water, it is a physical change.

- Take 2-3 pieces of ice in a 100 ml conical flask. Cork the flask well and weigh it. Note down its weight, say W_{ice} = 53 g.
- Now, heat the flask gently on the burner. The ice (solid) slowly melts into water (liquid). Weigh the flask again and note down its weight. The flask will weigh W_{water} 53 g. Thus, $W_{ice} = W_{water.}$
- Now, again heat the flask on the burner for a few more minutes. The water (liquid) starts getting converted into vapors (gas). Now, carefully weigh the flask again. The flask will weigh W_{gas} 53 g. $W_{ice} = W_{water} = W_{vapor}$
- Hence, from this activity, we observed that there is no change in the weight of the flask before and after heating.
- Therefore, according to the law of conservation of mass, mass can neither be created nor destroyed in a chemical reaction.

Total Mass of the Reactant = Total Mass of the Product

36. (b) Spirogyra

The figure shown above is that of Spirogyra, as it shows the presence of spirally arranged chloroplast and it is a filamentous algae.