

Section-A

1. Define the SI unit of work.

Ans: The SI unit of work is the joule. If a force of one Newton displaces a body by one meter, then the work done is said to be one joule.

2. What kind of energy transformation takes place when a body is dropped from some height?
Ans: When a body is dropped from some height, its potential energy gets converted into kinetic energy.

3. Name two acids that are present in acid rain.

Ans: Oxides of nitrogen and sulphur.

4. Name the disease caused by water contaminated by mercury.

Ans: Minamata disease.

5. a) How many atoms of sodium are there in a sample measuring 2×10^2 moles?

Ans: a) 1 mole of sodium = 6.022×10^{23} atoms of sodium

2×10^2 moles of sodium = $(6.022 \times 10^{23}) \times (2 \times 10^2)$ atoms of sodium
= 1.2044×10^{26} atoms of sodium

b) Write the formula of nitrate of B^{2+} and aluminum salt of X^- .

Ans: b) Nitrate of B^{2+} : $B(NO_3)_2$

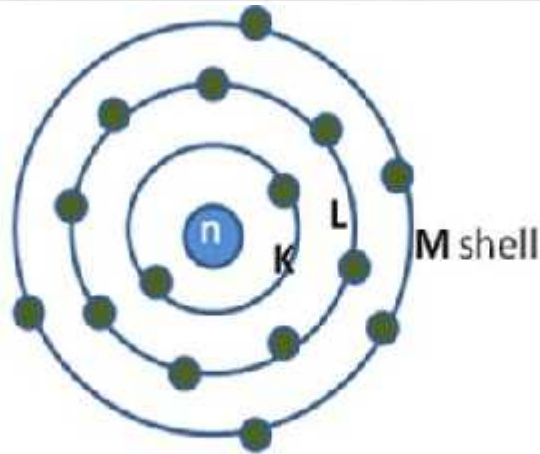
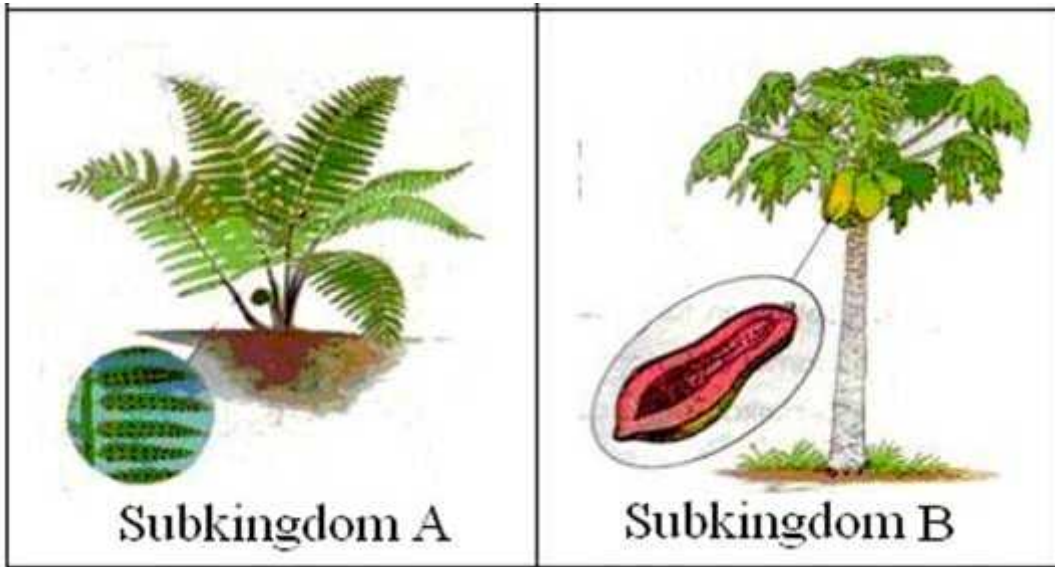
Aluminum salt of X^- : AlX_3

6. Draw a sketch of Bohr's model of the atom with five electrons in the "M" shell. Identify the element and also write its electronic configuration.

Ans:

There are a total of $2 + 8 + 5 = 15$ electrons in the element, and hence, the element is phosphorous, and its electronic configuration is 2, 8, 5.

7. The diagram given here shows characteristic features at various levels of the subkingdoms. Identify subkingdoms, and write any two differences between them.



Bohr's Model of atom for element having 5 electrons in the M shell

Ans:

Subkingdom A - Cryptogame
It includes seedless plants.
It includes vascular and non-vascular plants.

Subkingdom B - Phanaerogamae
It includes seed plants.
It includes vascular plants only.

8. Describe the class of warm-blooded animals in which the teeth are absent.

Ans: The class of warm blooded animals in which the teeth are absent is aves, which includes birds. Their forelimbs are modified into wings with feathers, and bear three clawless digits. Their hind limbs are strong and are developed for walking. Birds are arboreal in habitat. Their bones are light as they are hollow. Birds breathe through their lungs and have air sacs. They have a four-chambered heart. Aves are also egg-laying creatures. Examples include the parrot, peacock, hen, ostrich, etc.

9. State Archimedes' principle.

Ans: When a body is immersed fully or partially in a fluid, it experiences an upward force that is equal to the weight of the fluid displaced by it.

10. The relative density of iron is 7.7. What is the density in the SI system.

Ans: If the relative density of iron is 7.7, then its density in the CGS system is 7.7 g/cm^3 . Hence, its density in the SI system is 7700 kg/m^3 .

11. What are ultrasonic waves? Name three animals that can hear ultrasonic waves.

Ans: Sound waves that have frequency greater than 20 kHz are called ultrasonic waves. Dolphins, bats and porpoises can hear ultrasonic waves.

12. Describe any four methods of weathering of soil.

Ans: Weathering of soil is carried out by different agents:

- (i) Big rocks crack and break into particles of soil due to uneven contraction and expansion caused by various climatic conditions.
- (ii) Water logged in the cracks of rocks freezes, and the cracks widen, eventually breaking the rocks and forming soil.
- (iii) Lichens grow on the surface of rocks and release chemicals that powder the rocks to soil.
- (iv) Strong winds erode rocks and carry sand from one place to another.

13. What are the causes of water pollution?

Ans: The causes of water pollution include:

- (i) Dumping industrial chemicals and urban sewage into rivers and lakes.
- (ii) Fertilisers and pesticides used in farms running off into water bodies.

Dumping hot water from thermal power plants into water bodies, which raises the temperature of the water. This rise in temperature removes the dissolved oxygen and causes the death of many aquatic animals.

14. a) Calculate the molecular mass of $C_6H_{12}O_6$ and P_2O_5 .

(Atomic mass: C = 12, H = 1, O = 16, P = 31) (1)

Ans: a) Molecular mass of $C_6H_{12}O_6 = (6 \times 12) + (12 \times 1) + (6 \times 16) = 180 \text{ u}$

Molecular mass of $P_2O_5 = (2 \times 31) + (5 \times 16) = 142 \text{ u}$

b) Carbon and oxygen combine in the ratio of 3:8 by mass to form carbon dioxide. What mass of oxygen gas would be required to react completely with 36 g of carbon? (2)

Ans: b) Carbon and oxygen combine in the ratio of 3:8 by mass.

3 g of carbon combines with 8 g of oxygen

36 g of carbon combines with $\frac{8 \times 36}{3} = 96 \text{ g}$ of oxygen

15. Calculate the mass of:

(i) 1.5 moles of oxygen molecules

Ans: (i) 1 mole of oxygen molecules weigh = Molar mass = 32 g

1.5 mole of oxygen molecules weigh = $32 \times 1.5 \text{ g} = 48 \text{ g}$

(ii) 1.5 moles of oxygen atoms

Ans: (ii) 1 mole of oxygen atoms weigh = Atomic mass = 16 g

1.5 mole of oxygen atoms weigh = $16 \times 1.5 = 24 \text{ g}$

(iii) 3.011×10^{23} oxygen atoms (atomic mass: O = 16)

Ans: (iii) 6.022×10^{23} number of oxygen atoms weigh = 16 g

3.011×10^{23} number of oxygen atoms weigh = $\frac{16 \times 3.011 \times 10^{23}}{6.022 \times 10^{23}} = 8 \text{ g}$

16. Write any three differences between chordates and non-chordates.

Ans:

Non-chordates	Chordates
The notochord is absent.	The notochord is present at some developmental stages.
Pharyngeal gill slits are absent.	Pharyngeal gill slits that aid in respiration are present.
The central nervous system is solid and ventral.	The central nervous system is hollow and dorsal.
Respiratory pigment, if present, is in dissolved form in plasma in blood.	Respiratory pigment haemoglobin is present in RBC's.

17. Describe any three infectious agents.

1. Ans: Microbes such as bacteria, viruses, fungi, protozoa and worms cause diseases. These are called infectious agents. These agents absorb digested food from the host, and, in turn, cause diseases.

(i) Bacteria are unicellular organisms visible only under a microscope. Some diseases caused by bacteria are typhoid, cholera, tuberculosis and anthrax.

(ii) A virus is the smallest organism that can be seen through an electron microscope. Some diseases caused by viruses are the common cold, influenza, dengue fever and AIDS.

(iii) Fungi are microscopic and multi-cellular organisms that usually cause skin infections.

(iv) Protozoa are parasitic organisms that can be seen only under a microscope. Some diseases caused by protozoan organisms are sleeping sickness, Kala-azar and amoebiasis.

18. Describe the mode of transmission of diseases through air, water and animals, with examples.

Ans: Microbial organisms are transmitted from an infected person to a healthy person through direct contact, air, water, food, mosquitoes and other animals.

(i) Through air: Droplet nuclei containing microbes circulate in the air mainly in overcrowded and poorly ventilated areas, and cause diseases like the common cold, pneumonia and tuberculosis.

(ii) Through water: When the excreta of animals and humans suffering from infectious diseases get mixed with water, it causes diseases like cholera.

(iii) Through animals: Some animals carry infectious agents from a sick person to a healthy person. These animals are called vectors. The most common vectors are mosquitoes, dogs, etc. Animals like dogs and cats transfer the rabies virus when they bite human beings.

19. How can we prevent infectious diseases?

Ans: Infectious diseases can be prevented by taking different measures:

(i) Air-borne diseases can be prevented by providing living conditions that are not over-crowded.

(ii) Water-borne diseases can be prevented by providing clean drinking water.

(iii) Vector-borne diseases can be prevented by keeping our surroundings clean to prevent insects from breeding. Public hygiene is a basic step to prevent infectious diseases.

20. Derive the relation between the SI unit and the CGS unit for work.

Ans: The SI unit for work is the joule, and its CGS unit is the erg.

$$\begin{aligned}1 \text{ J} &= 1 \text{ N} \times 1 \text{ m} = 1 \text{ kg m/s}^2 \times 1 \text{ m} \\&= 1 \text{ kg m}^2/\text{s}^2 = 1 \text{ kg} \times (1 \text{ m})^2/(1 \text{ s})^2 \\&= 1000 \text{ g} \times (100 \text{ cm})^2/(1 \text{ s})^2 \\&= 10^3 \text{ g} \times 10^4 \text{ cm}^2/1 \text{ s}^2 = 10^7 \text{ g cm}^2/\text{s}^2 = 10^7 \text{ erg} \\ \therefore 1 \text{ J} &= 10^7 \text{ erg}\end{aligned}$$

21. A boy standing in front of a cliff claps and hears an echo at the end of 3 s. If the speed of sound in air is 342 m/s, find the distance between the cliff and the boy.

Ans: Time to hear echo of clap, $t = 3\text{s}$

Speed of sound in air, $v = 342 \text{ m/s}$

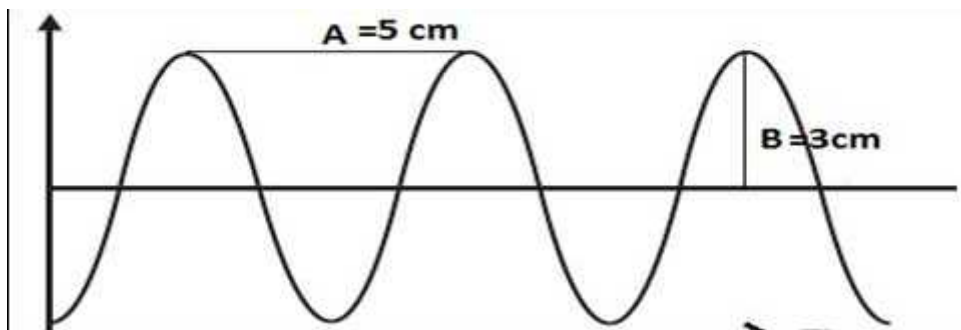
Let the distance of the cliff from the boy be 'd'.

Distance travelled by sound = $2d$

$$\text{Speed of sound} = \frac{\text{Distance}}{\text{Time}} = \frac{2d}{t}$$

$$\Rightarrow v = \frac{2d}{t} \Rightarrow d = \frac{vt}{2} = \frac{342 \times 3}{2} = 513 \text{ m}$$

22. Observe the graphical representation of a wave given here and answer the questions that follow. The quantity plotted along the X-axis is time, and against the Y-axis is displacement of the vibrating particle in the wave.



a) What is the nature of the wave?

Ans: a) The particles of the medium vibrate in a direction perpendicular to the direction of wave propagation. Hence, the wave is a transverse wave.

b) What is the wavelength of the wave?

Ans: b) The distance between two successive crests is equal to wave length. Hence, the wavelength of the wave in the figure is 5 cm.

c) What is the quantity denoted by the letter "B" in the figure?

Ans: c) The quantity denoted by the letter "B" in the figure is the maximum displacement of the vibrating particles, and hence, it is the amplitude of the wave.

23. a) Explain the term isotope with an example. (1)

Ans: a) Atoms of the same element with the same number of protons/atomic number, but with a different number of neutrons/mass number, are called isotopes. For example, ${}^1_1\text{H}$, ${}^2_1\text{H}$ and ${}^3_1\text{H}$ are the three isotopes of hydrogen.

b) Of the three fundamental particles of an atom, which elementary particle(s) influences the following properties of an element? Give suitable reasons for your answer.

i) The chemical identity of an atom (whether it is an atom of hydrogen or halogen)

Ans: b) i) The chemical identity of an atom depends upon the number of protons. Atomic number is defined as the number of protons, and no two elements can have the same atomic number.
ii) The mass of an atom (2)

Ans: ii) The mass of an atom depends upon the number of neutrons and protons. Electrons have a very negligible mass as compared to that of neutrons and protons.

c) What were the conclusions of Rutherford's alpha particle scattering experiment? (2)

Ans: c) The conclusions of Rutherford's alpha particle scattering experiment were:

- (i) There is a positively charged centre in an atom, called the nucleus. Nearly the entire mass of an atom resides in the nucleus.
 (ii) The electrons revolve around the nucleus in well-defined orbits.
 (iii) The size of the nucleus is very small as compared to the size of the atom.

Or

- a) What sub-atomic particles make up the nucleus? What is their mass and charge? (2)

Ans: a) The sub-atomic particles present in the nucleus of an atom are protons and neutrons. Both have a mass of 1u. A proton has a charge of +1, while a neutron is an uncharged particle.

- b) What is the importance of isotopes in medicine? (1)

Ans: b) Radioactive isotopes are used in medicine to trace aspects of body chemistry, due to their radioactive emissions. Radioactive isotopes are used in radiotherapy to kill malignant cancer cells.

- c) In Rutherford's scattering experiment, very few of the α -particles that hit the gold foil are deflected back. What does this suggest? (2)

Ans: c) The fact that very few of the α -particles that hit the gold foil in Rutherford's experiment are deflected back suggests that an atom has a heavy and positively-charged centre, and it occupies a very small volume. Hence, some α -particles are deflected back by the heavy positively-charged centre, while most of them pass through the surrounding empty space.

24. (a) What is the work done in increasing the velocity of a body of mass 2 kg from 4 m/s to 8 m/s? (3)

2. **Ans:** (a) Given:

Mass of body, $m = 2$ kg

Initial velocity of body, $u = 4$ m/s

Final velocity of body, $v = 8$ m/s

Initial kinetic energy of body, $KE_i = \left(\frac{1}{2}\right) \times mu^2 = \left(\frac{1}{2}\right) \times 2 \times 4^2 = 16$ J

Final kinetic energy of body, $KE_f = \left(\frac{1}{2}\right) \times mv^2 = \left(\frac{1}{2}\right) \times 2 \times 8^2 = 64$ J

Work done, $W = \text{Change in kinetic energy, } \Delta E = KE_f - KE_i = 64 - 16 = 48$ J

(b) If the velocity of a body is doubled, then what is the percentage increase in its kinetic energy? (2)

Ans: (b) Kinetic energy of a body is given by $\frac{1}{2}mv^2$.

Let the velocity of the body in the first case be v_1 . Hence, the kinetic energy of the body in the

first case is $KE_1 = \frac{1}{2}mv_1^2$. The velocity of the body in the second case is $v_2 = 2v_1$. Hence, the kinetic energy of the body in the second case is

$$KE_2 = \frac{1}{2}mv_2^2 = \frac{1}{2}m(2v_1)^2 = \frac{1}{2}m4v_1^2 = 4\left(\frac{1}{2}mv_1^2\right) = 4KE_1$$

$$\text{Percentage increase in kinetic energy} = \frac{KE_2 - KE_1}{KE_1} \times 100 = \frac{4KE_1 - KE_1}{KE_1} \times 100 = 300$$

Or

Name the kind of energy transformation that takes place in the following examples:

a) Electric heater

Ans: a) Electric heater: Electrical energy into heat energy

b) Dynamo

Ans: b) Dynamo: Mechanical energy into electrical energy

c) Microphone

Ans: c) Microphone: Sound energy into electrical energy

d) Electric cell

Ans: d) Electric cell: Chemical energy into electrical energy

e) Headphone

Ans: e) Headphone: Electrical energy into sound energy

25. Describe the following processes:

a. Biogeochemical cycle

Ans: a. **Biogeochemical cycle:** The cycling of chemicals between the biological and the geological world is called the biogeochemical cycle. The biotic and abiotic components of the biosphere constantly interact through these cycles. During these interactions, there is a transfer of nutrients between the living organisms, or bio, and the non-living environment, or geo, of the biosphere.

b. Greenhouse effect

Ans: b. **Greenhouse effect:** The earth reflects some of the solar radiation that it receives, back into the atmosphere as infrared radiation. Most of this infrared radiation does not escape back into space, since it is absorbed by atmospheric gases such as carbon dioxide, methane, nitrous oxide and ozone. These gases are commonly known as greenhouse gases. These gases send the infrared radiation back to the earth's surface, thereby heating the earth's surface again. This is called the greenhouse effect. It keeps the earth warm to sustain life.

c. Formation of ozone layer

Ans: c. **Formation of ozone layer:** Atomic (O) and molecular oxygen (O₂) react with each other in the presence of ultraviolet rays to form ozone. The upper layer of the atmosphere, known as the stratosphere, is rich in ozone molecules. Hence, this layer is called the ozone shield or the ozone layer. This layer absorbs the harmful ultraviolet radiations from the sun, thereby preventing them from reaching the earth's surface, which otherwise might damage life forms.

d. Water cycle

Ans: d. **Water cycle:** Water evaporates from water bodies due to the sun's heat, and returns as rain and snow, which, in turn, flow back into the seas via rivers. This cyclical movement of water from land to the ocean to the atmosphere and back to land is called the water cycle. When the oceans are heated during the day, water turns into water vapour and escapes into the atmosphere. This water vapour in the atmosphere changes to water droplets and condenses to form clouds. These clouds precipitate into rain, snow or fog. Much of the rain water flows into water bodies, while some of it penetrates the earth's surface and gets logged as groundwater. This is how water is maintained in the biosphere by the water cycle.

e. Decomposition

Ans: e. **Decomposition:** Dead plants and animals are decomposed by fungi and bacteria. This decomposition releases the carbon in the remains as carbon dioxide into the atmosphere.

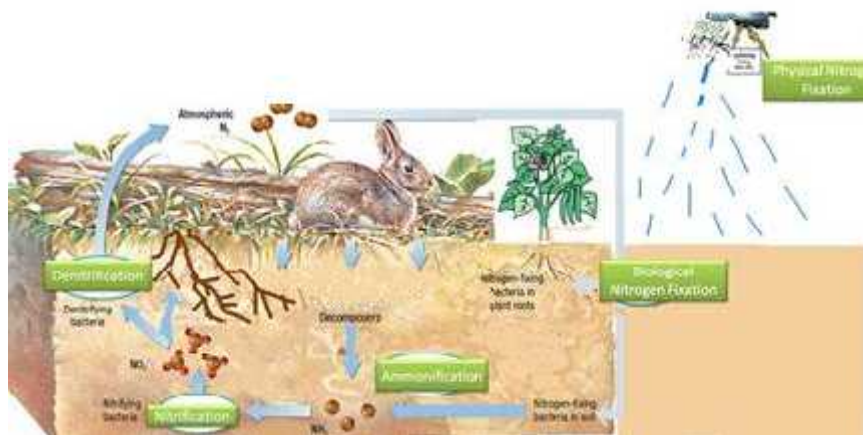
Or

Sketch a diagrammatic representation of the nitrogen cycle, and explain how nitrogen is replenished in the atmosphere.

Ans

an

DNA,



Nitrogen is essential constituent of proteins,

RNA, vitamins and chlorophyll. This makes nitrogen an essential nutrient for all life forms. Most living organisms cannot use atmospheric nitrogen directly. So, it needs to be converted into usable forms by fixation, either physically or biologically. The nitrogen cycle is the sequence by which nitrogen passes from the atmosphere to the soil and organisms, and is eventually released back into the atmosphere.

When lightning occurs, the high temperature and pressure combine nitrogen and water to form nitrates and nitrites. These compounds dissolve in water and are readily used by plants. This process of fixing nitrogen physically is called **physical nitrogen fixation**.

Legumes have nitrogen-fixing bacteria in their root nodules. These bacteria convert atmospheric nitrogen into ammonia, which is readily utilized by plants. Nitrogen-fixing bacteria along with free living bacteria in the soil carry out almost 90 per cent of nitrogen fixation. This process of fixing nitrogen in soil by microbes is called **biological nitrogen fixation**.

Plants utilize the nitrogen in soil to make their proteins. Animals gain nitrogen by eating the plants. When the plants and animals die, bacteria in the soil decompose the organic matter and release ammonia into the soil. This process is called **ammonification**.

Thereafter, through biological oxidation, ammonia is converted into nitrite, and nitrite into nitrate by bacteria in the soil. This process is called **nitrification**.

The nitrite and nitrate are finally converted into gaseous nitrogen by denitrifying bacteria, in a process called **denitrification**.

Section B

26. Among cat, dog, lion and wolf, which animals belong to the same family?

- a. Dog, lion
- b. Cat, lion
- c. Cat, dog
- d. Dog, wolf

Ans: Cat, lion

27. What type of seed is shown here?

- a. Monocot
- b. Dicot
- c. Sporophyll
- d. Spore

Ans: Monocot



28. Here is an egg-laying animal. Identify the class to which it belongs.



- a. Reptilia
- b. Amphibia

c. Aves

d. Mammalia

Ans: Mammalia

29. Organisms of which phylum show the notochord only at some stages during their lives?

a. Protochordata

b. Non-chordates

c. Hemichordata

d. Chordates

Ans: Protochordata

30. Identify the feature in which these two animals are similar?



- a. Mammary glands
- b. Urinary bladder
- c. Diaphragm
- d. Four-chambered heart

Ans: Four-chambered heart

31. Subhash cut a fresh water plant into small pieces, and he observed that each of these fragments grew into a new plant. Identify the plant.

- a. Sargassum
- b. Spirogyra

- c. Chalamydomonas
- d. Rhizopus

Ans: Spirogyra

32. A cuboidal block of dimensions $10\text{ cm} \times 6\text{ cm} \times 4\text{ cm}$ is placed on a surface. It exerts maximum pressure when the side with the dimensions ____ is in contact with the surface.

- a. $10\text{ cm} \times 4\text{ cm}$
- b. $10\text{ cm} \times 6\text{ cm}$
- c. $6\text{ cm} \times 4\text{ cm}$
- d. Any dimension

Ans: $6\text{ cm} \times 4\text{ cm}$

33. The SI unit for pressure is ____.

- a. dyn/cm^2
- b. dyn/m^2
- c. N/cm^2
- d. N/m^2

Ans: N/m^2

34. A balloon filled with air is immersed forcibly and gradually into a water trough. The balloon experiences maximum upthrust when it is immersed:

- a. Up to one-fourth of its volume in water
- b. Up to half of its volume in water
- c. Up to three-fourths of its volume in water
- d. Completely in water

Ans: Completely in water

35. The density of gold is $19.3\text{ g}/\text{cm}^3$. Its relative density is ____.

- a. 193
- b. 1.93
- c. 19.3
- d. 0.193

Ans: 19.3

36. The purity of gold in an ornament can be found, without destroying it, by using _____.

- a. The law of conservation of mass
- b. The principle of moments
- c. Archimedes' principle
- d. Bernoulli's principle

Ans: Archimedes' principle

37. The relative density of silver is 10.8. Its density is:

- a. 108 kg/m^3
- b. 1.08 g/m^3
- c. 10.8 g/m^3
- d. $10.8 \times 10^3 \text{ kg/m}^3$

Ans: $10.8 \times 10^3 \text{ kg/m}^3$

38. A man standing between two parallel cliffs fires a gun and hears two successive echoes at the end of 4 s and 6 s. The distance between the cliffs is ___ m.

(Speed of sound in air is 330 m/s.)

- a. 1600 m
- b. 1650 cm
- c. 1650 m
- d. 1590 m

Ans: 1650 m

39. The frequency of a tuning fork is 256 Hz. The number of vibrations made by the fork in 10 s is _____.

- a. 25.6
- b. 256
- c. 2560
- d. 5120

Ans: 2560

40. In which of the following does sound travel faster?

- a. Railway track
- b. Tissue paper
- c. Garden water pipe
- d. Car tyre

Ans: Railway track

41. The Galton whistle, also called a dog whistle, produces sounds in the range:

- a. below 20 Hz
- b. 20 Hz to 20 kHz
- c. above 20 kHz
- d. 10 Hz to 20 Hz

Ans: Above 20 kHz

OR

Section-A

1. What is the work done on a body moving in a circular path?

Ans: The work done on a body moving in a circular path is zero.

2. How many erg make a joule?

Ans: 10^7 erg make a joule.

3. What happens if the ozone layer covering the earth is completely depleted?

Ans: If the ozone layer is depleted, then UV radiations from the sun will reach the earth. This would be disastrous, because prolonged exposure to these rays have harmful effects on human beings, such as damage to skin cells and various types of skin cancers.

4. Name any two fossil fuels formed from dead plant and animal remains in the soil.

Ans: Coal, petroleum and natural gas.

5. Calculate the number of oxygen atoms in two moles of sulphuric acid.

Ans: The molecular formula of sulphuric acid is H_2SO_4 . 1 mole of H_2SO_4 contains 4
 $\times 6.022 \times 10^{23}$ atoms of oxygen

2 moles of H_2SO_4 contain $2 \times 4 \times 6.022 \times 10^{23}$ atoms of oxygen
 $= 4.82 \times 10^{24}$ atoms of oxygen

6. What is the drawback of Rutherford's model of the atom?

Ans: Rutherford's model of the atom has a small, dense positively charged central core, and electrons revolving around it. According to Clark Maxwell's theory of electromagnetic radiation, any particle in a circular orbit would undergo acceleration. During acceleration, a charged particle would radiate energy, and therefore, a revolving electron would lose energy and finally fall into the nucleus. If this were so, the atom should be highly unstable and would collapse. However, this does not happen, and an atom is quite stable. This is the drawback of Rutherford's model of the atom.

7. Write any two differences between amphibians and reptiles.

Ans:

Amphibians	Reptiles
The skin is moist and smooth.	The skin is dry and scaly.
Amphibians have a three-chambered heart.	Reptiles have a four-chambered heart.
Fertilization is external.	Fertilization is internal.

8. Write the different kingdoms included under Whittaker's classification.

Ans: The five-kingdom classification proposed by Whittaker includes Monera, Protista, Fungi, Plantae and Animalia.

9. A sealed cold drink tin of 400 g mass has a volume of 300 cm³. Calculate the density of the tin bottle.

Ans: Given:

Mass of the tin bottle, m= 400 g

Volume of the tin bottle, V = 300 cm³

Density of the tin bottle, D =?

According to the formula,

Density, $D = \frac{\text{Mass}}{\text{Volume}}$

Hence, density of tin bottle, $D = \frac{400}{300} = 1.33 \text{ g/cm}^3$

10. a) Why does ice float on water?

Ans: a) The density of ice is less than the density of water. Hence, ice floats on water.

b) How is a heavy ship able to float on water?

Ans: b). The weight of the water displaced by the ship is more than its own weight. Therefore, the ship floats on water.

11. a) What is the normal audible range of the human ear?

Ans: a) The audible range of a normal human ear is 20 Hz to 20 kHz.

b) What is infrasonic sound?

Ans: b) Sound of frequencies below 20 Hz is called infrasonic sound.

12. Write any two causes of air pollution.

Ans: The causes of air pollution include:

a) Burning fossil fuels releases suspended un-burnt hydrocarbon particles into the air.

b) Chemical industries release gases such as oxides of sulphur and nitrogen, carbon monoxide, and cyanides, which pollute the air. Emissions from vehicles add poisonous gases to the air.

c) Burning wood and coal, and forest fires add carbon monoxide, sulphur dioxide, etc. to the air.

13. Why does land near water bodies get colder faster at night?

Ans: During the day, soil gets heated faster than water. This makes the air above land also get heated faster than the air above water. This hot air above land starts rising, creating a low-pressure area. This causes air to move from the high-pressure area over the sea to the low pressure area over land, creating a sea breeze. This is the reason why land near water bodies gets colder faster at night.

14. a) Explain the difference between the symbols 4 P and P₄.

Ans: a) 4P represents four atoms of phosphorous, while P₄ represents a molecule of phosphorous. A molecule of phosphorous has an atomicity of 4.

b) Predict the formulae for the compounds that contain the following pairs of ions:

And: b) (i) Fe₂(SO₄)₃ (ii) Na₂CO₃

(ii) Fe³⁺ and SO₄²⁻ (ii) Na⁺ and CO₃²⁻

d) Calculate the molecular mass of aspirin, C₉H₈O₄ (atomic mass: H = 1, C = 12, O = 16).

Ans: d) Molecular mass of aspirin, C₉H₈O₄ = 9 × 12 + 8 × 1 + 4 × 16 = 180 u

15. Convert the following into moles:

(i) 150 g of CaCO₃

Ans: (i) Molar mass of CaCO₃ = 100g

100 g of CaCO₃ = 1 mole

150 of CaCO₃ = $\frac{150 \times 1}{100} = 1.5$ mole

(ii) 16 g of O₂

Ans: (ii) Molar mass of O₂ = 32 g

32 g of oxygen = 1 mole

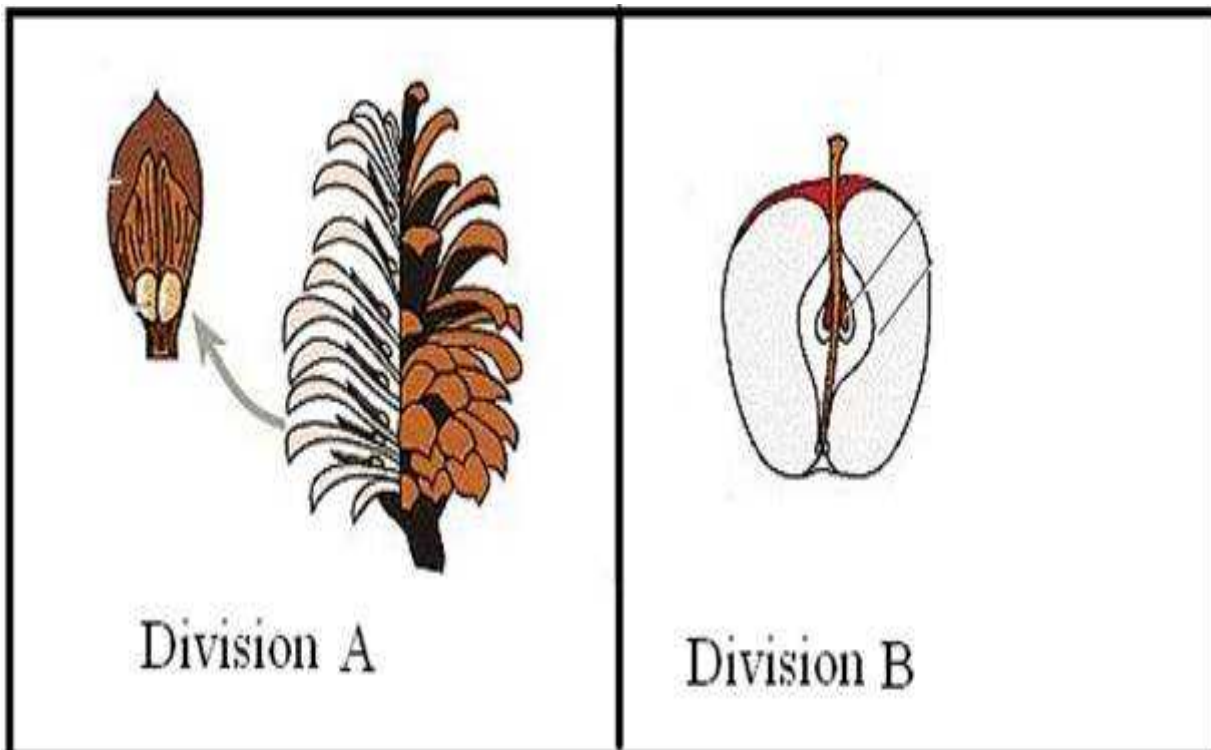
16 g of oxygen = $\frac{1 \times 16}{32} = 0.5$ mole of oxygen

(ii) 3.011 × 10²⁴ atoms of sulphur (atomic mass: Ca = 40, C = 12, O = 16, S = 32)

Ans: (iii) 6.022×10^{23} sulphur atoms = 1 mole

$$3.011 \times 10^{24} \text{ sulphur atoms} = \frac{1 \times 3.011 \times 10^{24}}{6.022 \times 10^{23}} = 5 \text{ moles}$$

16. The diagram given here shows some characteristic features of two divisions. Identify them and write any three differences between them.



Ans:

Division A-Gymnosperms

Ovules are not enclosed in an ovary.

Seeds are naked.

Sporophylls aggregate to form cones.

Vascular tissues such as xylem lacks vessels, phloem lacks companion cells.

Division B-Angiosperms

Ovules are enclosed in an ovary.

Seeds are enclosed in a fruit.

Sporophylls aggregate to form flower.

Vascular tissues such as xylem contains vessels, phloem contains companion cells.

17. Describe the AIDS disease.

Ans: AIDS was first recognized in the USA, in 1981. AIDS is caused by a virus named the Human Immuno Deficiency Virus, or HIV. Acquired Immuno Deficiency Syndrome or AIDS

is called so because the AIDS virus breaks down the body's immune cells and organs that comprise the immune system. As a result, the patient becomes susceptible to secondary infections like pneumonia, diarrhea with blood loss, tuberculosis, etc. The patient dies because of these major infections. AIDS is transmitted through sexual contact or from an infected mother to her child during pregnancy or through breastfeeding. It can also transmit through blood transfusion, and through contaminated syringes and needles.

18. Describe any three modes of entry of microbes that decide the site of manifestation within an organ or tissue.

Ans: The modes of entry of microbes that decide the site of manifestation within an organ or tissue are:

a) If microbes enter from the air through the nose, they localize in the lungs and cause diseases like tuberculosis.

b) If microbes enter through food or water via the mouth, they stay in the gut lining and cause diseases like typhoid.

c) If microbes enter the liver, like viruses do, they cause diseases like jaundice.

d) Microbes that cause malaria enter through a mosquito bite, infect the liver, and later destroy the red blood cells.

19. Explain the following terms:

a) Inflammation

1. Ans: a) Inflammation: It is the process in which an active immune system deploys many immune cells, such as macrophages, to an affected tissue to kill disease-causing microorganisms. Some local effects caused due by inflammation are swelling, pain, redness and fever.

b) Immune system

Ans: b) Immune system: We are protected from infectious agents by our immune system. The human body has specialized immune cells such as B and T lymphocytes, macrophages and eosinophils, and proteins such as antibodies, which help fight microbes. If these cells are successful, we may not be infected by a disease. If the number of microbes can be controlled by the immune cells, the symptoms of illness will be minor.

d) Vaccine

Ans: c) Vaccine: Pathogens are first killed or inactivated by chemicals or high temperatures. These inactivated pathogens or its products are injected into the body as a suspension, which is

called a vaccine. The first vaccine was developed against small pox by Edward Jenner, and smallpox was completely eradicated. So, Edward Jenner is called the “father of immunology”.

20. a) An object of mass 40 kg is raised to a height of 5 m above the ground. What is its potential energy?

Ans: a) Given:

Mass of object, $m = 40 \text{ kg}$

Height of object, $h = 5 \text{ m}$

Acceleration due to gravity, $g = 9.8 \text{ m/s}^2$

Potential energy, $PE = ?$

According to the formula, $PE = m \times g \times h$

$$PE = 40 \times 9.8 \times 5 = 1960 \text{ J}$$

b) If the object is allowed to fall, find its kinetic energy:

Ans: b) As the object descends, its potential energy is transformed into kinetic energy. Thus, the kinetic energy of the object

(i) When it is half-way down

Ans: (i) When it is half-way down = Half of potential energy at the point it is dropped

$$= \frac{1960}{2} = 980 \text{ J}$$

(iii) Just before it strikes the ground

Ans: (ii) Just before it strikes the ground = Potential energy of the body at its highest point = 1960 J

21. Give three examples where multiple reflection of sound is used.

Ans: Multiple reflection of sound is used in: a) Stethoscope: In a stethoscope, the sound of the patient’s heartbeat reaches the doctor’s ears by multiple reflection of sound.

b) Megaphone and a horn: In a megaphone and a horn the sound waves are prevented from spreading out by successive reflections and are confined to the air in the tube.

c) Musical instruments such as the trumpet and the Shehnai: These are designed to send sound by multiple reflections in a particular direction without spreading in all directions.

22. a) What is an echo?

Ans: a) When a progressive sound wave from a source encounters an obstacle and is reflected back towards the source, the reflected sound wave is called an echo.

b) At least how far should somebody stand from a surface that reflects sound so that she can hear an echo when she claps her hands (take velocity of sound = 340 m/s)?

Ans: b) An individual should stand at least 17 metres from a surface that reflects sound so that she can hear an echo when she claps her hands.

c) How is this distance affected when the temperature of the air increases?

Ans: c) The speed of sound increases with an increase in temperature. As a result, the minimum distance to hear an echo also increases with an increase in temperature.

23. a) Calculate the number of electrons in a P^{3-} ion if the atomic weight of phosphorus is 31 u and its atomic number is 15. (1)

Ans: a) Atomic number of P = 15 = Number of protons = Number of electrons

For a P^{3-} ion, the total number of electrons = 15 + 3 = 18

b) What is the difference between ^{12}C , ^{13}C and ^{14}C , and what do they represent? (1)

Ans: b) ^{12}C , ^{13}C and ^{14}C represent the isotopes of carbon. They differ in the number of neutrons. They have six protons each, but ^{12}C has six neutrons, ^{13}C has seven, and ^{14}C has eight neutrons.

c) An element is represented as $^{24}_{12}Mg$. Write its electronic configuration. What valency does it exhibit? (1)

Ans: c) $^{24}_{12}Mg$: Electronic configuration: 2, 8, 2. Valency = 2.

e) Describe the features of energy levels proposed by Bohr. (2)

Ans: d) The specific feature of Bohr's energy levels is that only special orbits with discrete energies are allowed. While revolving in these orbits or energy levels, the electrons do not radiate energy, that is, their energy is constant.

a) How many nucleons are present in an atom of nobelium, $^{254}_{102}No$? How many electrons are present?

Ans: a) Number of nucleons = 254

Number of electrons= 102

How many nucleons can be considered as neutrons? (2)

Ans: Number of neutrons= 254 - 102 = 152

b) Explain Thomson's model of the atom. (2)

Ans: b) Thomson proposed a plum pudding atom consisting of a positively charged 'pudding' with just enough lighter, negatively charged electrons embedded in it to produce a neutral atom. The electrons were like plums in the pudding.

c) ${}^{79}_{35}\text{Br}$ and ${}^{81}_{35}\text{Br}$ are present in the ratio of 1:1. Calculate the average atomic mass of an atom of Br. (1)

Ans: c) The average atomic mass of an atom of Br is: $(79 \times \frac{50}{100}) + (81 \times \frac{50}{100}) = 80 \text{ u}$

24. What type of energy transformation that takes place in the following? (a) Motor (b) Florescent lamp (c) Generator (d) Woman drawing water from a well with a bucket (e) Waterfall

Ans: a) In a motor, electrical energy is transformed into mechanical energy.

b) In a fluorescent lamp, electrical energy is transformed into light energy.

c) In a generator, mechanical energy is transformed into electrical energy.

d) When a woman draws water from a well with a bucket, muscular energy is transformed into mechanical energy.

e) In a waterfall, the potential energy of water is converted into kinetic energy.

Or

a) Define power. What is the commercial unit of energy? (2)

Ans: a) Power is the rate of work done. The commercial unit of energy is the kilowatt hour, and is also referred to as a "unit."

b) If there are three bulbs of 100 W each, and two motors of 1500 W each in a house, and all of them are used for five hours every day, then find the cost of the electricity consumed for the month of April, at Rs 5/- per unit. (3)

Ans: b) Number of bulbs = 3

Wattage of each bulb = 100 W

∴ Wattage of all bulbs = $3 \times 100 \text{ W} = 300 \text{ W}$

Number of motors = 2

Wattage of each motor = 1500 W

Wattage of all motors = $2 \times 1500 \text{ W} = 3000 \text{ W}$

∴ Combined wattage of bulbs and motors = $300 \text{ W} + 3000 \text{ W} = 3300 \text{ W} = 3.3 \text{ kW}$

Time for which appliances are used every day = 5 h

∴ Energy consumed by appliances every day = Power \times Time = $3.3 \text{ kW} \times 5 \text{ h} = 16.5 \text{ kWh}$.

Number of days in April = 30

∴ Total energy consumed in April = $16.5 \text{ kW h/day} \times 30 \text{ days} = 495 \text{ kW h} = 495 \text{ units}$

Cost of a unit = Rs 5

∴ Total cost of electricity consumed, $E = 495 \times 5 = \text{Rs } 2475$

25. Describe the following

a) Global warming

Ans: a) **Global warming:** In the last few decades, the amount of greenhouse gases, especially carbon dioxide, in the atmosphere has increased, primarily due to the burning of fossil fuels like coal and oil. This has resulted in continuous heating of the earth, which has led to global warming. Global warming causes glaciers and snow caps to melt, which results in a rise in sea level, which could submerge many coastal areas.

b) Depletion of ozone layer

Ans: b) **Depletion of ozone layer:** There was an imbalance between the production and degradation of ozone in the atmosphere. This degradation has occurred due to chlorofluorocarbons or CFC, which are mainly used as refrigerants in air-conditioners, refrigerators and aerosol products. These are carbon compounds with both chlorine and fluorine. The decrease in ozone is the worst in regions over the South Pole, that is, the Antarctic region. This thinned ozone layer is called an ozone hole.

c) Carbon cycle

Ans: c) **Carbon cycle:** The sequence in which carbon from the atmosphere is used by organisms and then released back onto the atmosphere is called the carbon cycle. Carbon is an essential part of carbohydrates, fats, proteins, nucleic acids and vitamins. In the presence of sunlight, plants use carbon dioxide in the atmosphere and convert it into carbohydrates through photosynthesis. All plants and animals break carbohydrates for energy, and release carbon dioxide through respiration. Dead plants and animals are decomposed by fungi and bacteria, and release carbon in the remains as carbon dioxide. Dead plant and animal remains in the soil are converted into fossil fuels. On burning these fuels, carbon dioxide is released back into the atmosphere.

d) Physical and biological nitrogen fixation

Ans: d) **Physical and biological nitrogen fixation:** When lightning occurs, the high temperature and pressure combine nitrogen and water to form nitrates and nitrites. These compounds dissolve in water and reach the soil, and are readily used by plants. This process of fixing nitrogen physically is called **physical nitrogen fixation**. Legumes have nitrogen-fixing bacteria in their root nodules. These bacteria convert atmospheric nitrogen into ammonia, which is readily utilised by plants. Nitrogen-fixing bacteria along with free living bacteria in the soil achieve 90 per cent of nitrogen fixation. This process of fixing nitrogen by microbes is called **biological nitrogen fixation**.

e) Oxygen cycle

Ans: e) **Oxygen cycle:** The sequence in which oxygen from the atmosphere is used by organisms and eventually released back into the atmosphere is called the oxygen cycle. Oxygen is found in the air in combined form as carbon dioxide, and in the earth's crust as carbonates, sulphates and nitrates. Plants and animals use atmospheric oxygen during respiration. Fossil fuels like coal and wood need atmospheric oxygen for combustion. Oxygen is returned to the atmosphere through photosynthesis by plants.

Or

Draw a schematic representation of the water cycle. Also explain how water is replenished in the ground and in the oceans.

Ans: Water evaporates from water bodies because of the heat from the sun, and returns as rain and snow, which, in turn, flow back into the seas via rivers. This cyclical movement of water from land to the ocean to the atmosphere and back to land is called the water cycle.

When the oceans get heated during the day, water enters the atmosphere as water vapour by the process of **evaporation**. There is another way in which water evaporates into the atmosphere. This happens through **transpiration**. Water from plants evaporates as vapour into the atmosphere through the leaves and stems.

This water vapour in the atmosphere changes to water droplets and collects to form clouds. This process is called **condensation**.

Sea breeze moves these clouds and carries them over land, where they break into rain, snow or fog. This is called **precipitation**.

Much of the rainwater flows into water bodies, and eventually runs off into the ocean. Some of it penetrates the earth's surface and is logged as groundwater. This is how water is maintained in the biosphere by the water cycle.

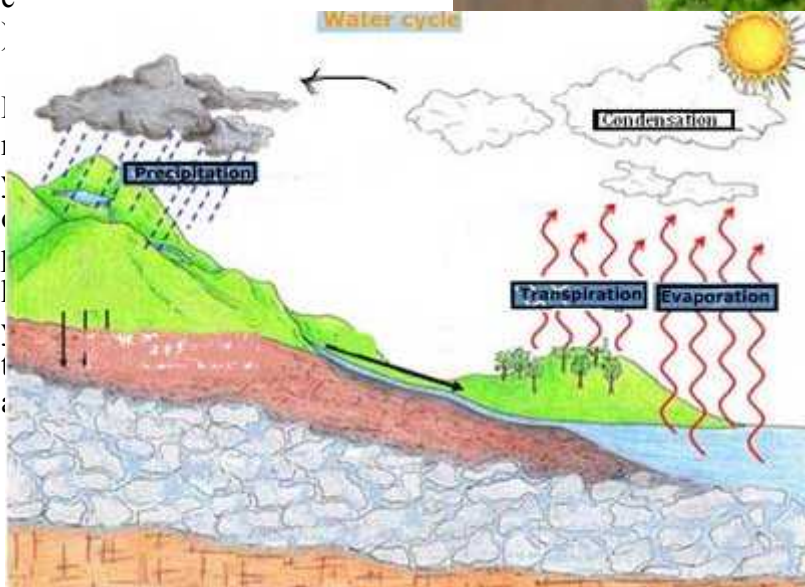
Section B

26. This plant shows a dominant gametophyte stage. Identify the division to which it belongs.

- a) Pteridophyta
- b) Thallophyta



c



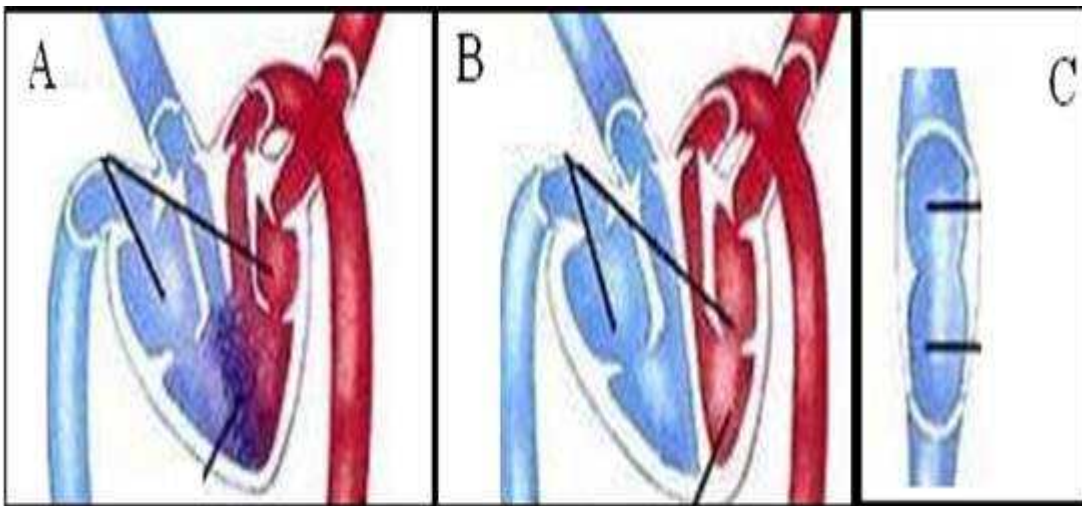
- d) Gymnosperms

Ans: Bryophyta

27. Here is an animal in which the brood pouch is seen in males. Identify the class to which this animal belongs.

- a) Amphibia
- b) Reptilia
- c) Mollusca
- d) Pisces

Ans: Pisces



28. Identify the organisms that show hearts A, B and C

a) A- Whale, B-

Ostrich, C-Salamander

- b) A-Salamander, B- Whale, C-Rohu
- c) A-Rohu, B- Salamander, C-Ostrich
- d) A-Ostrich, B-Rohu, C-Whale

Ans: A-Salamander, B- Whale, C-Rohu

29. How many teeth does a peacock have?

- a) Numerous
- b) 32



c) 34

d) None

Ans: None

30. Identify the characteristic feature of this animal that placed it under the phylum Annelida.

Segmented externally by grooves and internally by septa

a) Absence of exoskeleton

b) True coelom

c) Segmental nephridia

Ans: Segmented externally by grooves and internally by septa



31. John observed a flatworm under a microscope, and made the following observations, except one. Identify it.

a) Skeleton, circulatory and respiratory systems are absent

b) Coelom is absent

c) Suckers and hooks are present

d) Alimentary canal has mouth and anus

Ans: Alimentary canal has mouth and anus

32. The condition for which a solid sinks in a liquid is:

a) The density of the solid is less than that of the liquid

b) The density of the solid is greater than that of the liquid

c) The density of the solid is equal to that of the liquid

d) The volume of water displaced is greater than the volume of the solid

Ans: The density of the solid is greater than that of the liquid

33. A car lift in a workshop or garage works on:

- a) Pascal's law
- b) Archimedes' principle
- c) Laws of floatation
- d) Bernoulli's principle

Ans: Pascal's law

34. The units of density and relative density are _____ and _____, respectively.

- a) kg/m^3 , g/cm^3
- b) g/cm^3 , kg/m^3
- c) g/cm^3 , no units
- d) No unit, kg/m^3

Ans: g/cm^3 , no units

35. A force of 50 N acts on a surface of area 400 cm^2 . The pressure exerted on the surface is:

- a) 1250 Pa
- b) 0.125 Pa
- c) 125 Pa
- d) 125 dyne/cm^2

Ans: 1250

36. Which of the following experiences the greater upthrust?

- a) air balloon when immersed in water An
- b) A wooden block floating on water
- c) An iron nail when immersed in water
- d) A copper coin when immersed in kerosene

Ans: An air balloon when immersed in water

37. Which of the following properties of a solid tells us whether it can float or sink when immersed in water?

- a) Volume
- b) Mass
- c) Elasticity
- d) Density

Ans: Density

38. The persistence of sound in an auditorium is the result of:

- a) Single reflection of sound
- b) Single refraction of sound
- c) Repeated refraction of sound
- d) Repeated reflection of sound

Ans: Repeated reflection of sound

39. A tuning fork vibrates 256 times a second, and the sound propagates at 340 m/s. The length of each wave produced by the fork is approximately ___ m.

- a) 1.5
- b) 1.7
- c) 1.9
- d) 1.3

Ans: 1.3

40. Several pebbles are dropped into a trough containing water at the rate of one pebble per second. Each pebble generates a ripple in the trough. The frequency of the ripples is ___ Hz.

- a) 1
- b) 2

c) 3

d) 4

Ans: 1

41. A sound wave is incident on a cement wall in a room at an angle of 25° . The wave reflects at an angle of ____ from the plane of the wall.

a) 25°

b) 45°

c) 65°

d) 75°

Ans: 65°