

Solved Paper 2022

Science (TERM-I)

CLASS-X

Time : 90 Minutes

Max. Marks : 40

General Instructions :

- This question paper contains 60 questions out of which 50 questions are to be attempted. All questions carry equal marks.
- The question paper consists three sections – Section A, B and C.
- Section–A consists of 24 questions. Attempt any 20 questions from Q. No. 1 to 24.
- Section–B also consists of 24 questions. Attempt any 20 questions from Q. No. 25 to 48.
- Section–C consists of three Case Studies containing 12 questions and 4 questions in each case. Attempt any 10 from Q. No. 49 to 60.
- There is only one correct option for every Multiple Choice Question (MCQ). Marks will not be awarded for answering more than one option.
- There is no negative marking.

Series : JSK/2

031/2/4

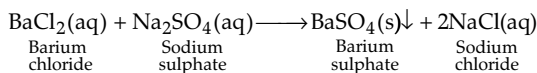
SECTION - A

Section-A consists of 24 questions (Q. No. 1 to 24). Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

1. A student took sodium sulphate solution in a test tube and added barium chloride solution to it. He observed that an insoluble substance has formed. The colour and molecular formula of the insoluble substance is:
- (a) Grey, Ba_2SO_4 (b) Yellow, $Ba(SO_4)_2$
(c) White, $BaSO_4$ (d) Pink, $BaSO_4$

Ans. Option (c) is correct.

Explanation: On adding a solution of barium chloride to sodium sulphate solution, a white colour precipitate of barium sulphate is formed along with the formation of sodium chloride salt. The chemical reaction is as follows:



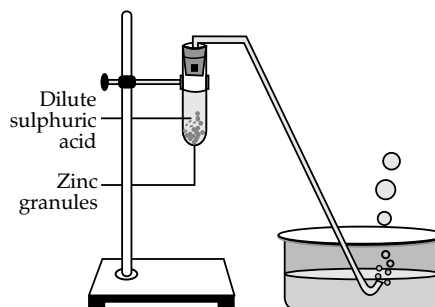
2. Which of the following oxide(s) is/are soluble in water to form alkalies?
- (i) Na_2O (ii) SO_2
(iii) K_2O (iv) NO_2
(a) (i) and (iii) (b) (i) only
(c) (ii) and (iv) (d) (iii) only

Ans. Option (a) is correct.

Explanation: Most of the metal oxides are insoluble in water but sodium oxide (Na_2O) and potassium oxide

(K_2O) dissolve in water to form alkalies. On the other hand, most non-metallic oxides dissolve in water to form acids.

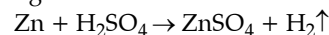
3. Study the diagram given below and identify the gas formed in the reaction.



- (a) Carbon dioxide which extinguishes the burning candle.
(b) Oxygen due to which the candle burns more brightly.
(c) Sulphur dioxide which produces a suffocating smell.
(d) Hydrogen which while burning produces a popping sound.

Ans. Option (d) is correct.

Explanation: Zinc reacts with dilute sulphuric acid to form zinc sulphate and hydrogen gas. When a burning candle is brought near the hydrogen gas, it burns with a pop sound which confirms the presence of hydrogen gas.

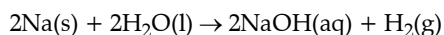


4. Sodium reacts with water to form sodium hydroxide and hydrogen gas. The balanced equation which represents the above reaction is;

- (a) $\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + 2\text{H}_2\text{(g)}$
 (b) $2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + \text{H}_2\text{(g)}$
 (c) $2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{NaOH(aq)} + 2\text{H}_2\text{(g)}$
 (d) $2\text{Na(s)} + \text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)} + 2\text{H}_2\text{(g)}$

Ans. Option (b) is correct.

Explanation: Sodium reacts with water to form sodium hydroxide solution and hydrogen gas. The balanced chemical equation for the given reaction is represented as:



5. Which of the options in the given table are correct?

Option	Natural Source	Acid Present
(i)	Orange	Oxalic acid
(ii)	Sour milk	Lactic acid
(iii)	Ant sting	Methanoic acid
(iv)	Tamarind	Acetic acid

- (a) (i) and (ii) (b) (i) and (iv)
 (c) (ii) and (iii) (d) (iii) and (iv)

Ans. Option (c) is correct.

Explanation: Lactic acid is present in sour milk and methanoic acid is present in ant sting.

6. $\text{C}_6\text{H}_{12}\text{O}_6\text{(aq)} + 6\text{O}_2\text{(aq)} \rightarrow 6\text{CO}_2\text{(aq)} + 6\text{H}_2\text{O(l)}$

The above reaction is a/an

- (a) displacement reaction
 (b) endothermic reaction
 (c) exothermic reaction
 (d) neutralisation reaction

Ans. Option (c) is correct.

Explanation: The given reaction is an example of respiration. During respiration, energy is being released. Therefore, it is an exothermic reaction.

7. Which of the following statements about the reaction given below are correct?



- (i) HCl is oxidized to Cl_2
 (ii) MnO_2 is reduced to MnCl_2
 (iii) MnCl_2 acts as an oxidizing agent
 (iv) HCl acts as an oxidizing agent
 (a) (ii), (iii) and (iv) (b) (i), (ii) and (iii)
 (c) (i) and (ii) only (d) (iii) and (iv) only

Ans. Option (c) is correct.

Explanation: In this reaction, MnO_2 is losing oxygen to form MnCl_2 , so manganese dioxide (MnO_2) is being reduced to manganese dichloride (MnCl_2). On the other hand, HCl is losing hydrogen to form Cl_2 , so hydrochloric acid (HCl) is being oxidised to chlorine (Cl_2).

Therefore, manganese dioxide (MnO_2) is the oxidising agent while hydrochloric acid (HCl) is the reducing agent.

8. Select from the following the statement which is true for bases.

- (a) Bases are bitter and turn blue litmus red.
 (b) Bases have a pH less than 7.
 (c) Bases are sour and change red litmus to blue.
 (d) Bases turn pink when a drop of phenolphthalein is added to them.

Ans. Option (d) is correct.

Explanation: Phenolphthalein changes color from colourless to pink in basic solution. Rest all are the properties of acids.

9. Study the following table and choose the correct option:

	Salt	Parent Acid	Parent Base	Nature of Salt
(a)	Sodium Chloride	HCl	NaOH	Basic
(b)	Sodium Carbonate	H_2CO_3	NaOH	Neutral
(c)	Sodium Sulphate	H_2SO_4	NaOH	Acidic
(d)	Sodium Acetate	CH_3COOH	NaOH	Basic

Ans. Option (d) is correct.

Explanation: A basic salt is made up of combination of a weak acid and a strong base. Since, sodium acetate is made up of weak acid (acetic acid) and a strong base (NaOH), it is basic in nature.

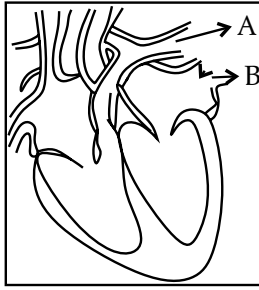
10. It is important to balance the chemical equations to satisfy the law of conservation of mass. Which of the following statements of the law is incorrect?

- (a) The total mass of the elements present in the reactants is equal to the total mass of the elements present in the products.
 (b) The number of atoms of each element remains the same, before and after a chemical reaction.
 (c) The chemical composition of the reactants is the same before and after the reaction.
 (d) Mass can neither be created nor can it be destroyed in a chemical reaction.

Ans. Option (c) is correct.

Explanation: During a chemical reaction, new atoms or molecules of reactants collide to form new bonds and break old bonds the reacting atoms rearrange themselves to form the product. As a result, the chemical composition of the reactants gets modified after the reaction. Hence, this is the incorrect statement.

11. Consider the following statements in connection with the functions of the blood vessels marked A and B in the diagram of a human heart as shown.



- (i) Blood vessel A – It carries carbon dioxide rich blood to the lungs.
- (ii) Blood vessel B – It carries oxygen rich blood from the lungs.
- (iii) Blood vessel B – Left atrium relaxes as it receives blood from this blood vessel.
- (iv) Blood vessel A – Right atrium has thick muscular wall as it has to pump blood to this blood vessel.

The correct statements are

- (a) (i) and (ii) only (b) (ii) and (iii) only
- (c) (ii), (iii) and (iv) (d) (i), (ii) and (iii)

Ans. Option (d) is correct.

Explanation: Blood vessel A is the pulmonary artery and blood vessel B is a pulmonary vein. The pulmonary vein carries oxygenated blood from the lungs to the left atrium that relaxes to receive the blood from this blood vessel.

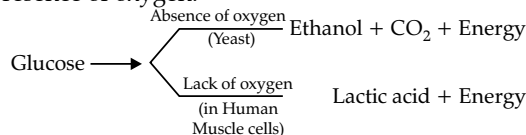
The pulmonary artery carries deoxygenated blood from the right ventricle of the heart to the lungs.

12. In living organisms during respiration which of the following products are not formed if oxygen is not available?

- (a) Carbon dioxide + Water
- (b) Carbon dioxide + Alcohol
- (c) Lactic acid + Alcohol
- (d) Carbon dioxide + Lactic Acid

Ans. Option (a) is correct.

Explanation: During respiration, under anaerobic conditions, carbon dioxide and water is not formed. Water is produced only under aerobic conditions *i.e.*, presence of oxygen.



13. The correct statements with references to single celled organisms are

- (i) Complex substances are not broken down into simpler substances.
- (ii) Simple diffusion is sufficient to meet the requirements of exchange of gases.
- (iii) Specialised tissues perform different functions in the organism.
- (iv) Entire surface of the organism is in contact with the environment for taking in food.

- (a) (i) and (iii) (b) (ii) and (iii)
- (c) (ii) and (iv) (d) (i) and (iv)

Ans. Option (c) is correct.

Explanation: In single celled organisms like *Amoeba*, the complex food substances are broken down into simpler substances by the process of digestion that takes place inside the food vacuole. Simple diffusion is sufficient to meet the requirement of the exchange of gases. Specialised tissues are not formed because the tissue is formed by a group of cells, not a single cell. The entire surface of the organism is in direct contact with the environment so that they can capture their food.

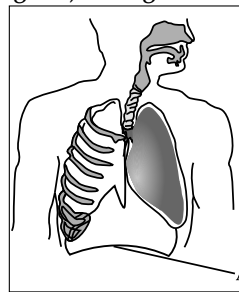
14. Which one among the following is not removed as a waste product from the body of a plant?

- (a) Resins and Gums (b) Urea
- (c) Dry Leaves (d) Excess Water

Ans. Option (b) is correct.

Explanation: Urea is not formed in the plants. The excretory products that are produced by the plants are resins, gums, latex, dry leaves and excess water.

15. Which of the following statements are correct in reference to the role of A (shown in the given diagram) during a breathing cycle in human beings?

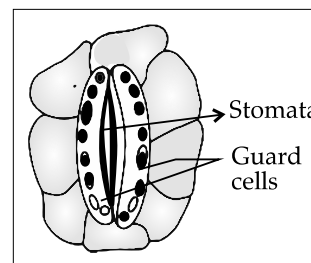


- (i) It helps to decrease the residual volume of air in lungs.
 - (ii) It flattens as we inhale.
 - (iii) It gets raised as we inhale.
 - (iv) It helps the chest cavity to become larger.
- (a) (ii) and (iv) (b) (iii) and (iv)
 - (c) (i) and (ii) (d) (i), (ii) and (iv)

Ans. Option (a) is correct.

Explanation: The diaphragm contracts and flattens during inhalation to increase the chest cavity. It gets raised and relaxed during the exhalation to push out the air from the lungs.

16. Which one of the following conditions is true for the state of stomata of a green leaf shown in the given diagram?



- (a) Large amount of water flows into the guard cells.
- (b) Gaseous exchange is occurring in large amount.

- (c) Large amount of water flows out from the guard cells.
- (d) Large amount of sugar collects in the guard cells.

Ans. Option (c) is correct.

Explanation: The given diagram represents closed stomatal pores. The stomatal pores close when a large amount of water flows out of the guard cells due to environmental stress such as high temperature.

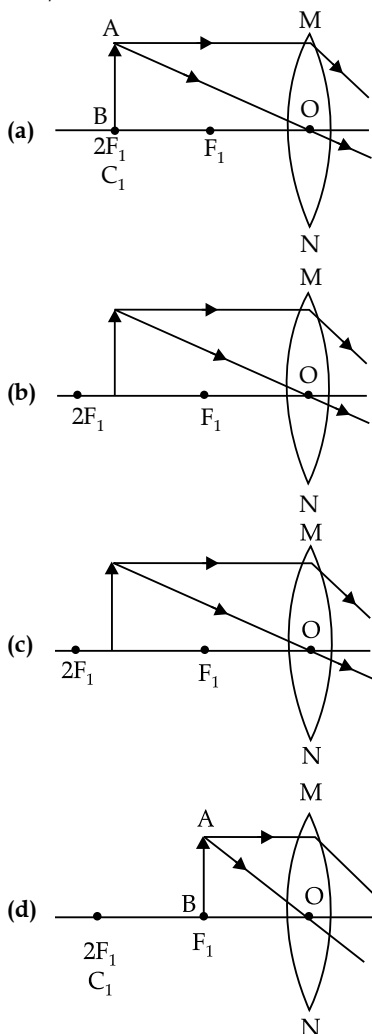
17. In which of the following is a concave mirror used?

- (a) A solar cooker
- (b) A rear view mirror in vehicles
- (c) A safety mirror in shopping malls
- (d) In viewing full size image of distant tall buildings

Ans. Option (a) is correct.

Explanation: A concave mirror is used in the solar cooker as concave mirrors absorb the entire incident light and reflect it to a single focal point. This reflected light is very powerful because it carries a lot of thermal energy.

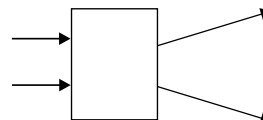
18. A student wants to obtain magnified image of an object AB as on a screen. Which one of the following arrangements shows the correct position of AB for him/her to be successful?



Ans. Option (c) is correct.

Explanation: The students want to obtain a magnified image on the screen then the position of the object should be between F and 2F because only real image can be formed on the screen.

19. The following diagram shows the use of an optical device to perform an experiment of light. As per the arrangement shown, the optical device is likely to be a;



- (a) Concave mirror
- (b) Concave lens
- (c) Convex mirror
- (d) Convex lens

Ans. Option (b) is correct.

Explanation: In the given diagram, rays are diverging from the optical device. Thus, it is a concave lens, which is also known as diverging lens.

20. A ray of light starting from air passes through medium A of refractive index 1.50, enters medium B of refractive index 1.33 and finally enters medium C of refractive index 2.42. If this ray emerges out in air from C, then for which of the following pairs of media the bending of light is least?

- (a) air-A
- (b) A-B
- (c) B-C
- (d) C-air

Ans. Option (b) is correct.

Explanation: The difference of refractive index is minimum when the ray of light travels from medium A to medium B. Thus, the change in speed of light is minimum for A-B interface and therefore, the bending of light is least for A-B interface.

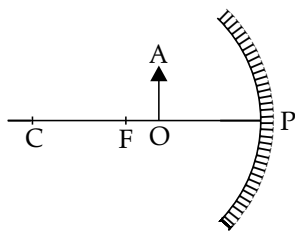
21. Which of the following statements is not true for scattering of light?

- (a) Colour of the scattered light depends on the size of particles of the atmosphere.
- (b) Red light is least scattered in the atmosphere.
- (c) Scattering of light takes place as various colours of white light travel with different speed in air.
- (d) The fine particles in the atmospheric air scatter the blue light more strongly than red. So the scattered blue light enters our eyes.

Ans. Option (c) is correct.

Explanation: When a white light enters the atmosphere, it is scattered by small particles present in the atmosphere according to their wavelengths. As the red light has the highest wavelength among all the colours in the visible light, it is scattered the least but blue light scatters the most.

22. For the diagram shown, according to the new Cartesian sign convention the magnification of the image formed will have the following specifications:

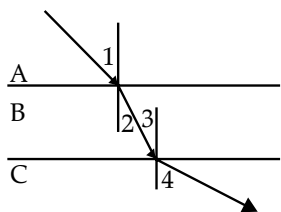


- (a) Sign – Positive, Value – Less than 1
 (b) Sign – Positive, Value – More than 1
 (c) Sign – Negative, Value – Less than 1
 (d) Sign – Negative, Value – More than 1

Ans. Option (b) is correct.

Explanation: In the given figure, object OA is placed in front of a concave mirror between pole and focus. Thus, a virtual, erect and enlarged image will form behind the mirror. Therefore, magnification is positive and its value should be more than 1.

23. A ray of light is incident as shown. If A, B and C are three different transparent media, then which among the following options is true for the given diagram?



- (a) $\angle 1 > \angle 4$ (b) $\angle 1 < \angle 2$
 (c) $\angle 3 = \angle 2$ (d) $\angle 3 > \angle 4$

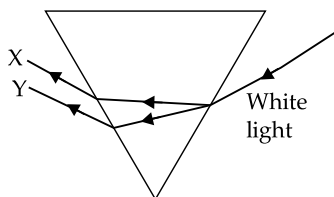
Ans. Option (c) is correct.

Explanation: From the given diagram, $\angle 1 > \angle 2$, $\angle 4 > \angle 3$ and $\angle 1 = \angle 4$

From the geometry of the figure, the two normals are parallel to each other and $\angle 2$ and $\angle 3$ are alternate interior angles.

Therefore, $\angle 3 = \angle 2$

24. In the diagram given below, X and Y are the end colours of the spectrum of white light. The colour of 'Y' represents the



- (a) Colour of sky as seen from earth during the day.
 (b) Colour of the sky as seen from the moon.
 (c) Colour used to paint the danger signals.
 (d) Colour of sun at the time of noon.

Ans. Option (c) is correct.

Explanation: When white light is incident on a prism, it splits into seven colours. The red light bends the least while the violet bends the most. Thus, in the given diagram, Y represents red colour used to paint the danger signals.

SECTION - B

Section-B consists of 24 questions (Q.No.25 to 48). Attempt any 20 questions from this section. The first attempted 20 questions would be evaluated.

25. Which one of the following reactions is categorised as thermal decomposition reaction?

- (a) $2\text{H}_2\text{O}(\lambda) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
 (b) $2\text{AgBr}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \text{Br}_2(\text{g})$
 (c) $2\text{AgCl}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cl}_2(\text{g})$
 (d) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

Ans. Option (d) is correct.

Explanation: Decomposition of calcium carbonate (CaCO_3) is an example of thermal decomposition reaction because in this reaction, a single reactant decomposes into multiple products by the action of heat.

26. Consider the pH value of the following acidic samples:

S.No.	Sample	pH Value
1.	Lemon Juice	2.2
2.	Gastric Juice	1.2
3.	Vinegar	3.76
4.	Dil. Acetic acid	3.0

The decreasing order of their H^+ ion concentration is

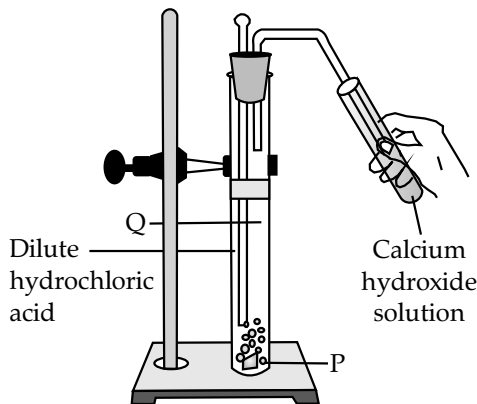
- (a) $3 > 4 > 1 > 2$ (b) $2 > 1 > 3 > 4$
 (c) $2 > 1 > 4 > 3$ (d) $3 > 4 > 2 > 1$

Ans. Option (c) is correct.

Explanation: The decreasing order of H^+ ion concentration is $2 > 1 > 4 > 3$. It is because, more is the concentration of H^+ ions, lesser is the value of pH.

27. Study the experimental set up shown in given figure and choose the correct option from the following:

	P	Q	Change observed in calcium hydroxide solution
(a)	K_2CO_3	Cl_2 gas	No change
(b)	KHCO_3	CO_2 gas	No change
(c)	KHCO_3	H_2 gas	Turns milky
(d)	K_2CO_3	CO_2 gas	Turns milky



Ans. Option (d) is correct.

Explanation: Metal carbonates or metal hydrogen carbonate upon reaction with acid lead to the formation of salt, water and carbon dioxide. The carbon dioxide gas thus produced turns the lime water milky. Therefore, P is K_2CO_3 , Q is CO_2 gas, and the calcium hydroxide solution *i.e.* lime water turns milky. 28. Which one of the following structures correctly depicts the compound CaCl_2 ?

- (a) $\text{Ca}^{2+} \left[\begin{array}{c} \times \times \\ \times \text{Cl} \times \\ \times \times \end{array} \right]^{2-}$ (b) $\left[\begin{array}{c} \times \times \times \\ \times \text{Ca} \times \\ \times \times \times \end{array} \right]^{2+} \left[\begin{array}{c} \times \times \\ \times \text{Cl} \times \\ \times \times \end{array} \right]_2$
- (c) $\text{Ca}^{2+} \left[\begin{array}{c} \times \times \\ \times \text{Cl} \times \\ \times \times \end{array} \right]_2$ (d) $\left[\begin{array}{c} \times \times \times \\ \times \text{Ca} \times \\ \times \times \times \end{array} \right]^{2+} \left[\begin{array}{c} \times \times \\ \times \text{Cl} \times \\ \times \times \end{array} \right]_2^-$

Ans. Option (d) is correct.

Explanation: Calcium with electronic configuration 2, 8, 8, 2 loses two electrons to form Ca^{2+} ion and attains noble gas configuration whereas, chlorine with electronic configuration 2, 8, 7 gains one electron to form Cl^- ion. Therefore, two electrons lost by calcium are gained by two chlorine atoms to form CaCl_2 .

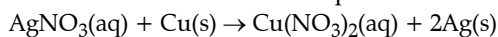
Thus, the correct structure for calcium chloride is: $\left[\begin{array}{c} \times \times \times \\ \times \text{Ca} \times \\ \times \times \times \end{array} \right]^{2+} \left[\begin{array}{c} \times \times \\ \times \text{Cl} \times \\ \times \times \end{array} \right]_2^-$

29. The pair(s) which will show displacement reaction is/ are

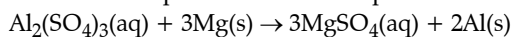
- (i) NaCl solution and copper metal
 (ii) AgNO_3 solution and copper metal
 (iii) $\text{Al}_2(\text{SO}_4)_3$ solution and magnesium metal
 (iv) ZnSO_4 solution and iron metal
- (a) (ii) only (b) (ii) and (iii)
 (c) (iii) and (iv) (d) (i) and (ii)

Ans. Option (b) is correct.

Explanation: A displacement reaction is a chemical reaction in which a more reactive element displaces a less reactive element from its compound. Since, Cu is more reactive than Ag; it can displace Ag from its nitrate solution and show a displacement reaction.



Similarly, magnesium being more reactive than aluminium displaces it from its sulphate solution.



30. Which of the following salts do not have the water of crystallisation?

- (i) Bleaching Powder (ii) Plaster of Paris
 (iii) Washing soda (iv) Baking soda
- (a) (ii) and (iv) (b) (i) and (iii)
 (c) (ii) and (iii) (d) (i) and (iv)

Ans. Option (d) is correct.

Explanation: The chemical formula of the given salts are :

Bleaching powder: CaOCl_2

Plaster of Paris: $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

Washing soda: $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

Baking soda: NaHCO_3

Therefore, bleaching powder and baking soda do not have the water of crystallisation.

Question No. 31-35 consists of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
 (c) (A) is true but (R) is false.
 (d) (A) is false but (R) is true.

31. Assertion (A) : Sodium hydrogen carbonate is used as an ingredient in antacids.

Reason (R) : NaHCO_3 is a mild non-corrosive basic salt.

Ans. Option (b) is correct.

Explanation: Sodium hydrogen carbonate (NaHCO_3) is used as an ingredient in antacids because being alkaline, it neutralises excess acid in the stomach and provides relief. It is a mild, non corrosive salt.

32. Assertion (A) : Burning of natural gas is an endothermic process.

Reason (R) : Methane gas combines with oxygen to produce carbon dioxide and water.

Ans. Option (d) is correct.

Explanation: Burning of natural gas is an exothermic process as heat is evolved in the process. Burning of methane gas leads to the production of carbon dioxide, water and heat.

33. Assertion (A) : Nitrogen is an essential element for plant growth and is taken up by plants in the form of inorganic nitrates or nitrites.

Reason (R) : The soil is the nearest and richest source of raw materials like Nitrogen, Phosphorus and other minerals for the plants.

Ans. Option (b) is correct.

Explanation: Nitrogen is an essential element for plant growth but it cannot fix atmospheric nitrogen directly. Thus, is taken up by plants in the form of inorganic nitrates or nitrites, or ammonia. Soil is composed of minerals such as nitrogen, phosphorus and potassium.

34. Assertion (A) : Sun appears reddish at the time of Sunrise and Sunset.

Reason (R) : Distance travelled by sunlight in the atmosphere is lesser during sunrise and sunset as compared to noon.

Ans. Option (c) is correct.

Explanation: The Sun appears reddish at the time of sunrise or sunset because light from the Sun near the horizon passes through thicker layers of air and larger distance in the earth's atmosphere before reaching our eyes. The distance covered by sunlight is larger in the case of sunrise and sunset where it is lesser during noon.

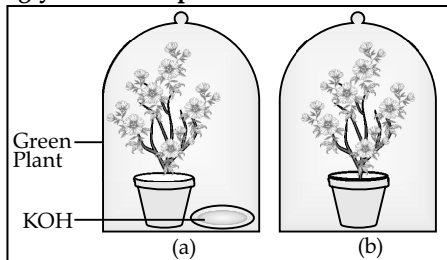
35. Assertion (A) : Hydrochloric acid helps in the digestion of food in the stomach.

Reason (R) : Hydrochloric acid creates an acidic medium to activate protein digesting enzymes.

Ans. Option (a) is correct.

Explanation: The gastric glands present in the wall of the stomach release hydrochloric acid, pepsinogen and mucus. Hydrochloric acid provides the acidic medium for the activation of pepsinogen into pepsin.

36. A student was asked to write a stepwise procedure to demonstrate that carbon dioxide is necessary for photosynthesis. He wrote the following steps. The wrongly worded step is:



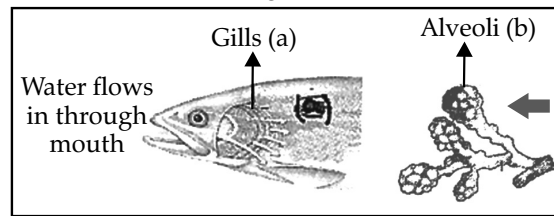
- Both potted plants are kept in dark room for at least three days.
- Bottom of the bell jars is sealed to make them air tight.
- Both potted plants are kept in sunlight after the starch test.
- A leaf from both the plants is taken to test the presence of starch.

Ans. Option (c) is correct.

Explanation: The given experiment is performed to test the role of carbon dioxide in photosynthesis. In fig. (a) KOH is used to absorb carbon dioxide. The steps are as follows:

- Two healthy potted plants are taken and kept in dark for three days so that all starch produced is consumed.
- The potted plants are then kept in airtight situation inside the bell jars to prevent further entry of carbon dioxide into it.
- Then the plants are kept in sunlight for two hours before the starch test so that plant can undergo photosynthesis and produce new starch.
- A leaf was plucked from each plant to carry the starch detection test.

37. Respiratory structures of two different animals—a fish and a human being are as shown.



Observe (a) and (b) and select one characteristic that holds true for both of them.

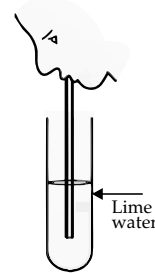
- Both are placed internally in the body of animal.
- Both have thin and moist surface for gaseous exchange.
- Both are poorly supplied with blood vessels to conserve energy.
- In both the blood returns to the heart after being oxygenated.

Ans. Option (b) is correct.

Explanation: Both the structures, gills and alveoli have thin and moist surface which help in the easy diffusion of respiratory gases. Gills are located externally beneath the operculum of a fish while alveoli are located internally in the lungs of humans. Both are richly supplied with blood to facilitate exchange of gases.

In the case of humans, the blood returns to the heart after it becomes oxygenated while in case of fish, they have single circulation so blood does not enter the heart after being oxygenated.

38. Observe the diagram of an activity given below. What does it help to conclude, when the person exhales into the test-tube?



- Percentage of carbon dioxide is more in inhaled air.
- Fermentation occurs in the presence of oxygen.
- Percentage of carbon dioxide is more in the exhaled air.
- Fermentation occurs in the presence of carbon dioxide.

Ans. Option (c) is correct.

Explanation: When we blow through a pipe, the exhaled air contains more percentage of carbon dioxide, which turns the lime water milky. So, the given test confirms the presence of high percentage of carbon dioxide in the exhaled air.

39. If a lens can converge the sun rays at a point 20 cm, away from its optical centre, the power of this lens is
 (a) +2D (b) -2D
 (c) +5D (d) -5D

Ans. Option (c) is correct.

Explanation: Focal length of the converging lens (convex lens), $f = +20 \text{ cm} = 0.20 \text{ m}$

Power of the lens is given as:

$$P = \frac{1}{f}$$

Or
$$P = \frac{1}{0.20} = +5 \text{ D}$$

40. The radius of curvature of a converging mirror is 30 cm. At what distance from the mirror should an object be placed as to obtain a virtual image?
 (a) Infinity
 (b) 30 cm
 (c) Between 15 cm and 30 cm
 (d) Between 0 cm and 15 cm

Ans. Option (d) is correct.

Explanation: Radius of curvature of converging mirror = 30 cm

To obtain virtual image, in case of concave mirror (converging mirror), object should be between pole and focus.

Using Focal length, $f = \frac{\text{Radius of curvature}}{2}$

Or
$$f = \frac{30}{2} = 15 \text{ cm}$$

Therefore, the object should be placed between 0 cm and 15 cm.

41. The length of small intestine in a deer is more as compared to the length of small intestine of a tiger. The reason for this is
 (a) Mode of intake of food.
 (b) Type of food consumed.
 (c) Presence or absence of villi in intestines.
 (d) Presence or absence of digestive enzymes.

Ans. Option (b) is correct.

Explanation: Herbivores like deer consume plants that contain cellulose. Hence, they need a longer small intestine to allow the cellulose to be digested. Carnivores like tiger eat meat. Since, meat is easier to digest as compared to cellulose; hence, they have a shorter small intestine compared to length of small intestine of deer (herbivores).

42. Identify the two components of phloem tissue that help in transportation of food in plants.
 (a) Phloem parenchyma & sieve tubes
 (b) Sieve tubes & companion cells
 (c) Phloem parenchyma & companion cells
 (d) Phloem fibres and sieve tubes

Ans. Option (b) is correct.

Explanation: The translocation of food and other substances takes place in the sieve tubes with the help of adjacent companion cells both in upward and downward directions. Phloem parenchyma helps in

food storage and phloem fiber gives strength to the plant.

43. A converging lens forms a three times magnified image of an object, which can be take on a screen. If the focal length of the lens is 30 cm, then the distance of the object from the lens is:

- (a) -55 cm (b) -50 cm
 (c) -45 cm (d) -40 cm

Ans. Option (d) is correct.

Explanation: Magnification of convex lens, $m = -3$

Focal length, $f = 30 \text{ cm}$

Object distance, $u = ?$

As we know, magnification, $m = \frac{v}{u} = -3$

Or
$$v = -3u$$

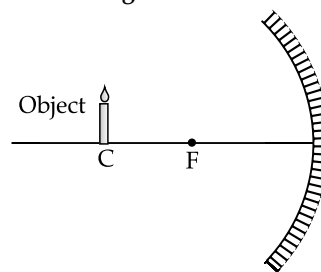
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-3u} - \frac{1}{u} = \frac{1}{30}$$

$$-\frac{4}{3} \times \frac{1}{u} = \frac{1}{30}$$

$$u = -40 \text{ cm}$$

44. Which of the following statements is not true in reference to the diagram shown above?

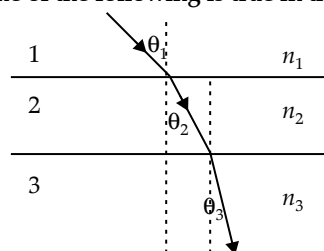


- (a) Image formed is real.
 (b) Image formed is enlarged.
 (c) Image is formed at a distance equal to double the focal length.
 (d) Image formed is inverted.

Ans. Option (c) is correct.

Explanation: Since, the candle is at the centre of curvature of the concave lens, the image will form at the centre of curvature of the mirror itself. Hence, the image formed will be real, inverted and of same size as that of the candle.

45. In the diagram shown above n_1 , n_2 and n_3 are refractive indices of the media 1, 2 and 3 respectively. Which one of the following is true in this case?



- (a) $n_1 = n_2$ (b) $n_1 > n_2$
 (c) $n_2 > n_3$ (d) $n_3 > n_1$

Ans. Option (d) is correct.

Explanation: When the light enters from optically rarer to optically denser medium, it bends towards the normal. While travelling from n_1 to n_2 , light bends towards the normal, so $n_2 > n_1$.

Similarly, $n_3 > n_2$

Therefore, $n_3 > n_1$

46. The refractive index of medium A is 1.5 and that of medium B is 1.33. If the speed of light in air is 3×10^8 m/s, what is the speed of light in medium A and B respectively?

- (a) 2×10^8 m/s and 1.33×10^8 m/s
 (b) 1.33×10^8 m/s and 2×10^8 m/s
 (c) 2.25×10^8 m/s and 2×10^8 m/s
 (d) 2×10^8 m/s and 2.25×10^8 m/s

Ans. Option (d) is correct.

Explanation: Speed of light in air, $c = 3 \times 10^8$ m/s

Let the speed of light in medium A and B be v_A and v_B respectively.

Speed of light in a medium of refractive index n is given by :

$$v = \frac{c}{n}$$

Thus, $v_A = 3 \times \frac{10^8}{1.5} = 2 \times 10^8$ m/s

Now, $v_B = 3 \times \frac{10^8}{1.33} = 2.25 \times 10^8$ m/s

47. An object of height 4 cm is kept at a distance of 30 cm from the pole of a diverging mirror. If the focal length of the mirror is 10 cm, the height of the image formed is

- (a) +3.0 cm (b) +2.5 cm
 (c) +1.0 cm (d) +0.75 cm

Ans. Option (c) is correct.

Explanation: Height of the object, $h = 4$ cm

Object distance, $u = -30$ cm

Focal length, $f = 10$ cm (for diverging mirror)

Using mirror formula,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{u}{v} = \frac{u}{f} - 1$$

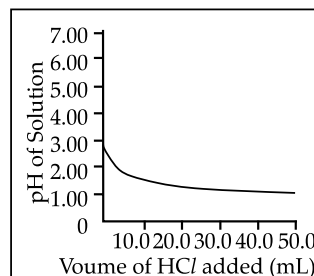
$$\frac{u}{v} = \left(\frac{-30}{10} \right) - 1 = -4$$

Magnification, $m = \frac{\text{Image height}}{\text{Object height}} = \frac{hi}{ho}$

$$= \frac{(-v)}{u} = \frac{1}{4}$$

Image height (hi) = $\frac{h}{4} = \frac{4}{4} = +1$ cm

48. 50.0 mL of tap water was taken in a beaker. Hydrochloric acid was added drop by drop to water. The temperature and pH of the solution was noted. The following graph was obtained. Choose the correction statements related to this activity.



- (i) The process of dissolving an acid in water is highly endothermic.
 (ii) The pH of the solution increases rapidly on addition of acid.
 (iii) The pH of the solution decreases rapidly on addition of acid.
 (iv) The pH of tap water was around 7.0
 (a) (i) and (ii) (b) (i) and (iii)
 (c) (iii) and (iv) (d) (ii) and (iv)

Ans. Option (c) is correct.

Explanation: Based on the given graph, the pH of the solution decreases as the volume of the added HCl increases. This means, more is the concentration of the acid, less is the pH of the solution. Also, the pH of tap water is around 7.0.

SECTION - C

Section-C consists of three cases followed by questions. There are a total of 12 questions (Q. No. 49 to 60) in this section. Attempt any 10 questions from this section. The first attempted 10 questions would be evaluated.

Case-I : A student, took four metals P, Q, R and S and carried out different experiments to study the properties of metals. Some of the observations were :

- All metals could not be cut with knife except metal R.
- Metal P combined with oxygen to form an oxide M_2O_3 which reacted with both acids and bases.
- Reaction with water.
 P – Did not react either with cold or hot water but reacted with steam
 Q – Reacted with hot water and the metal started floating
 R – Reaction violently with cold water.
 S – Did not react with water at all.

Based on the above observations answer the following:

49. Out of the given metals, the one which needs to be stored using kerosene is
 (a) P (b) R
 (c) S (d) Q

Ans. Option (b) is correct.

Explanation: Metal R is sodium that can be cut by knife and needs to be stored under kerosene because it reacts violently with cold water.

50. Out of the given metals, the metal Q is

- (a) Iron (b) Zinc
(c) Potassium (d) Magnesium

Ans. Option (d) is correct.

Explanation: Metal Q is magnesium as magnesium reacts with hot water to form magnesium hydroxide and hydrogen. It also starts floating due to the bubbles of hydrogen gas sticking to its surface.

51. Metal which forms amphoteric oxides is

- (a) P (b) Q
(c) R (d) S

Ans. Option (a) is correct.

Explanation: Metal P forms an oxide M_2O_3 , which show both acidic as well as basic behaviour. Such metal oxides, which react with both acids as well as bases to produce salts and water, are known as amphoteric oxides.

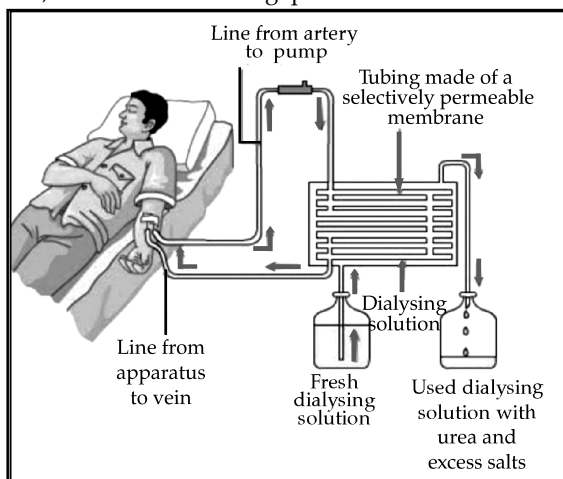
52. The increasing order of the reactivity of the four metals is

- (a) $P < Q < R < S$ (b) $S < R < Q < P$
(c) $S < P < Q < R$ (d) $P < R < Q < S$

Ans. Option (c) is correct.

Explanation: Since, metal S did not react with water, it is the least reactive metal. Metal P is more reactive than S as it did not react either with cold or hot water but reacted with steam. Metal Q is more reactive than P because it reacted with hot water. Metal R is the most reactive metal as it reacted violently with cold water. Therefore, the order of reactivity of metals is $S < P < Q < R$.

Case-II : The figure shown below represents a common type of dialysis called as Haemodialysis. It removes waste products from the blood, such as excess salts, and urea which are insufficiently removed by the kidney in patients with kidney failure. During the procedure, the patient's blood is cleaned by filtration through a series of semi-permeable membranes before being returned to the blood of the patients. On the basis of this, answer the following questions:



53. The haemodialyser has semi-permeable lining of tubes which help to:

- (a) To maintain osmotic pressure of blood.
(b) To filter nitrogenous wastes from the dialysing solution.
(c) In passing the waste products in the dialysing solution.
(d) To pump purified blood back into the body of the patient.

Ans. Option (c) is correct.

Explanation: Haemodialyser helps in the passing of nitrogenous waste products such as urea in the dialysing solution. During this passage, the waste products from the blood pass into the dialysing fluid through diffusion and the purified blood is pumped back into the patient.

54. Which one of the following is not a function of Artificial Kidney?

- (a) To remove nitrogenous wastes from the blood.
(b) To remove excess fluids from the blood.
(c) To reabsorb essential nutrients from the blood.
(d) To filter and purify the blood.

Ans. Option (c) is correct.

Explanation: The artificial kidney is similar to normal kidney except the process of reabsorption of essential nutrients from the blood which does not occur in it.

55. The 'used dialysing' solution is rich in;

- (a) Urea and excess salts
(b) Blood cells
(c) Lymph
(d) Proteins

Ans. Option (a) is correct.

Explanation: In artificial kidney, the used dialysing solution is rich in nitrogenous wastes like urea and excess salts. Blood cells, proteins and lymph are not removed during dialysis.

56. Which part of the nephron in human kidney, serves the function of reabsorption of certain substances?

- (a) Glomerulus
(b) Bowman's Capsule
(c) Tubules
(d) Collecting duct

Ans. Option (c) is correct.

Explanation: The selective reabsorption of certain substances like sodium ion, potassium ion, glucose, salts and major amount of water occurs in the tubules of the nephron in the human kidney.

Case III : A compound microscope is an instrument which consists of two lenses L_1 and L_2 . The lens L_1 called objective, forms a real, inverted and magnified image of the given object. This serves as the object for the second lens L_2 ; the eye piece. The eye piece functions like a simple microscope or magnifier. It produces the final image, which is inverted with respect to the original object, enlarged and virtual.

57. What types of lenses must be L_1 and L_2 ?

- (a) Both concave
- (b) Both convex
- (c) L_1 – concave and L_2 – convex
- (d) L_1 – convex and L_2 – concave

Ans. Option (b) is correct.

Explanation: Both the images formed by lens L_1 and L_2 are magnified, but the concave lens always form diminished image. Thus, both the lenses L_1 and L_2 are convex lens.

58. What is the value and sign of magnification (according to the new Cartesian sign convention) of the image formed by L_1 ?

- (a) Value = Less than 1 and Sign = Positive
- (b) Value = More than 1 and Sign = Positive
- (c) Value = Less than 1 and Sign = Negative
- (d) Value = More than 1 and Sign = Negative

Ans. Option (d) is correct.

Explanation: Image formed by L_1 is real, inverted and magnified. Thus, its magnification is negative and more than 1.

59. What is the value and sign of magnification (according to the new Cartesian sign convention) of the image formed by L_2 ?

- (a) Value = Less than 1 and Sign = Positive
- (b) Value = More than 1 and Sign = Positive
- (c) Value = Less than 1 and Sign = Negative
- (d) Value = More than 1 and Sign = Negative

Ans. Option (b) is correct.

Explanation: Image formed by L_2 is virtual and enlarged. Thus, its magnification should be positive and more than 1.

60. If power of the eyepiece (L_2) is 5 diopters and it forms an image at a distance of 80 cm from its optical centre, at what distance should the object be?

- (a) 12 cm
- (b) 16 cm
- (c) 18 cm
- (d) 20 cm

Ans. Option (b) is correct.

Explanation: Power of the lens, L_2 , $P = 5 \text{ D}$

$$\text{Focal length of lens, } f = \frac{1}{P}$$

$$\text{or } f = \frac{1}{5} = 0.2 \text{ m or } 20 \text{ cm}$$

$$\text{Image distance, } v = -80 \text{ cm}$$

$$\text{Object distance, } u = ?$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\left(\frac{1}{-80} \right) - \frac{1}{u} = \frac{1}{20}$$

$$\frac{1}{u} = \frac{1}{(-80)} - \frac{1}{20}$$

$$u = -16 \text{ cm}$$

Hence, distance of object from optical centre is 16 cm on the same side.

