CBSE
Class X Science
Sample Paper – 4 (Reference Solutions)
2024 - 25

SECTION - A

1. Correct option-c:(ii) and (iii).
Sour milk consist of lactic acid and ant sting has methanoic acid.

2. Correct option – c : Al > Zn > Fe > Cu
Al > Zn > Fe > Cu is the decreasing order of metals in reactivity series.

3. Correct option – c : both (i) and (ii) correct
When we heat copper sulphate crystals, their water of crystallization is removed, and the salt turns into white amorphous powder.

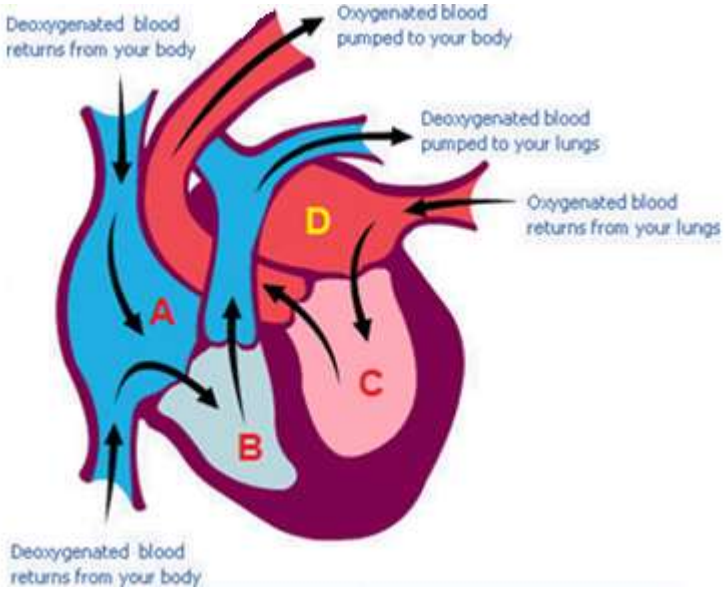
4. Correct answer- c: Exothermic reaction
During respiration, carbohydrates (glucose) combine with oxygen in the cell and energy is released hence it is considered an exothermic reaction.
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy

5. Correct answer- b: Sodium hydroxide.
Fat or oil + sodium hydroxide → Soap + Glycerol

6. Correct option – d: R > P > Q
R > P > Q
Red colour: pH range (0 - 2)
Green colour: pH range (5 - 8)
Violet colour: pH range (13 - 14)

7. Correct option – b: Na_2CO_3
Sodium hydroxide absorbs carbon dioxide from the air to form sodium carbonate.
$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

8. Correct option c. Oxygenated blood returns from the lungs and enters the aorta.
A – Right auricle, B – Right ventricle, C – Left ventricle, D –Left auricle



9. Correct option a. Opening and closing of stomata.
1 → Guard cells, 2 → Stomata, 3 → Chloroplast, 4 → Nucleus
The guard cells regulate the opening and closing of stomata.

10. Correct option – d : Natural selection can alter the frequencies of an inherited trait.
From Mendel's experiments and the laws, he formulated, it is clear that,

- In every organism, two copies of a gene, called alleles, control a single trait.
- When two parents, homozygous for a character, are crossed, in the F_1 generation only one parental character is observed and that is the dominant character.
- For a recessive character to appear, it has to be in a homozygous state e.g., tt (short plant) or rr (wrinkled seed).

The fourth statement, natural selection can alter the frequencies of an inherited character, is true with respect to theories of evolution but is not a direct conclusion of Mendel's experiments.

11. Correct option – d : P, Q and R
P- Stigma, Q – Style, R – Ovary, S – Anther, T – Filament
Stigma, style, and ovary constitute the carpel of a flower.

12. Correct option – d: All of the above
The plants A and B show movement in response to stimuli. These movements help the plant to adapt to the environment and adverse conditions. Such movements are called tropic movements. They are important for the growth and development of plants.

13. Correct option – c) at 12 cm
For magnification of -1, the object must be placed at 2F' = 2 × 6 = 12 cm

14. Correct option – c) Reversing the direction of current.
Reversing the direction of current does not affect the strength of an electromagnet.

15. Correct option – b) Consumer
Animals that feed upon plants or other animals are called consumers. Man cannot produce his own food. He obtains his food from plants or other animals. So, man is regarded as a consumer.

16. Correct option – b) Wilted flowers, pencil shavings, vegetable peels
Biodegradable items – Old clothes, wilted flowers, pencil shavings, vegetable peels
Non-biodegradable items - Polythene bags, glass bangles, bronze statue.

17. Correct option – a: Both A and R are true, and R is the correct explanation of A.
The colour of copper sulphate solution changes when iron nail is kept immersed in it due to the displacement reaction taking place between iron and copper leading to formation of iron sulphate.

18. A is false but R is true.
The sepals are collectively known as the calyx, and the petals are collectively known as the corolla. So, the assertion is false.
Sepals protect the flower when they are in the stage of bud and support the petals when in bloom. So, the reason is true.

19. Both A and R are true, and R is the correct explanation of A.
Jute bags can be used repeatedly for shopping and get decomposed when discarded. They are biodegradable. Polythene bags keep on accumulating as solid waste and harm our environment since they are non-biodegradable. Hence, using jute bags while shopping is more eco-friendly than using polythene bags. So, both assertion and reason are true and the reason correctly explains the assertion.

20. Correct option – c) A is true, but R is false.
At the junction of the optic nerve and retina, there are no light-sensitive cells due to which there is no image formation at the spot. This spot is called the blind spot.

SECTION - B

21. The lime water would turn milky because of carbon dioxide passing through it.
The chemical reaction is as follows:
$Ca(OH)_2 + CO_2 \rightleftharpoons CaCO_3 + H_2O$

22. It is said that sexual reproduction promotes diversity of characters in the offspring because the process involves fusion of the gametes from two different and sexually distinct individuals. During fusion, the genetic constitution of the gametes leads to variation in the offspring. This genetic variation helps species to survive better in the changing environment which is necessary for evolution.

23. Blood in the arteries moves because of the pressure of blood from the heart. Each time the heart pumps, it pushes the blood a little further. Thus, blood in the arteries flows with jerks and is under pressure.
Veins do not rely on the heart to move blood. Veins have a system of valves to keep the blood from not moving backward, and muscles contract the veins to move the blood.

OR

Differences between single circulation and double circulation in vertebrates:

Single circulation	Double circulation
• Blood passes through the heart only once in one complete cycle.	• Blood passes through the heart twice in one complete cycle.
• Heart has only deoxygenated blood.	• Heart has both oxygenated and deoxygenated blood.
• It is less efficient.	• It is more efficient.

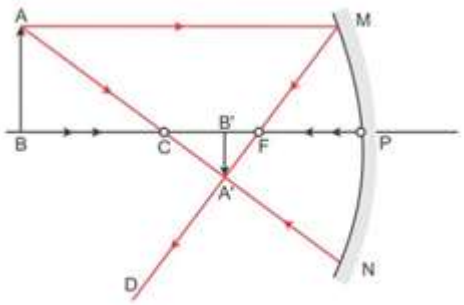
24.

a) Alloys have high resistivity, so they can generate more heat for same amount of current passing through them.

b) Alloys have high melting points and so they do not melt easily, while pure metals have low melting points.

c) Thus, heating elements used in appliances like electric iron and electric toaster are made of alloys rather than pure metals.

25.



Object beyond C

We know,

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

v = ?, f = - 5 cm (focal length of concave mirror)

u = - 20 cm

$\therefore \frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-5}-\frac{1}{-20}=\frac{-15}{100}$

$\therefore v = -6.67$ cm

Thus, the image is formed at a distance of 6.67 cm between the centre of curvature and the focus.

OR

By the principle of reversibility,

$_a\mu_g=\frac{1}{_g\mu_a}$

$\therefore _g\mu_a=\frac{1}{3/2}=\frac{2}{3}$ or $\frac{2}{3}\times\frac{2}{2}=\frac{4}{6}$

$\therefore _g\mu_a=\frac{4}{6}$

26. A person having a vegetarian food habit is close to the producer level and gets maximum amount of energy as compared to the organisms at a higher trophic level. This is because only 10% of energy is passed on from one trophic level to another. So, as we move closer to the level of producers, more energy is obtained. Hence, vegetarian food habit helps us in getting more energy.

SECTION – C

27. Lead nitrate gives out brown fumes. The brown fumes are of nitrogen dioxide (NO_2).
Type of this chemical reaction is thermal decomposition of lead nitrate.
The chemical reaction in the above experiment is as follows:

$$2\ Pb(NO_3)_{2(s)} \longrightarrow 2\ PbO_{(s)} + 4\ NO_{2(g)} \uparrow + O_{2(g)} \uparrow$$

28. Sugar crystals become charred to give black solid mass on heating.
A single compound decomposed or broke down to give two products. This is a decomposition reaction. In this reaction sugar molecules are decomposed by the action of heat. Hence, this reaction is a thermal decomposition reaction.
The balanced chemical reaction is as follows:

$$C_{12}H_{22}O_{11} \xrightarrow{Heat} 12\ C + 11\ H_2O$$

Sucrose (Carbohydrate) — Carbon — Water

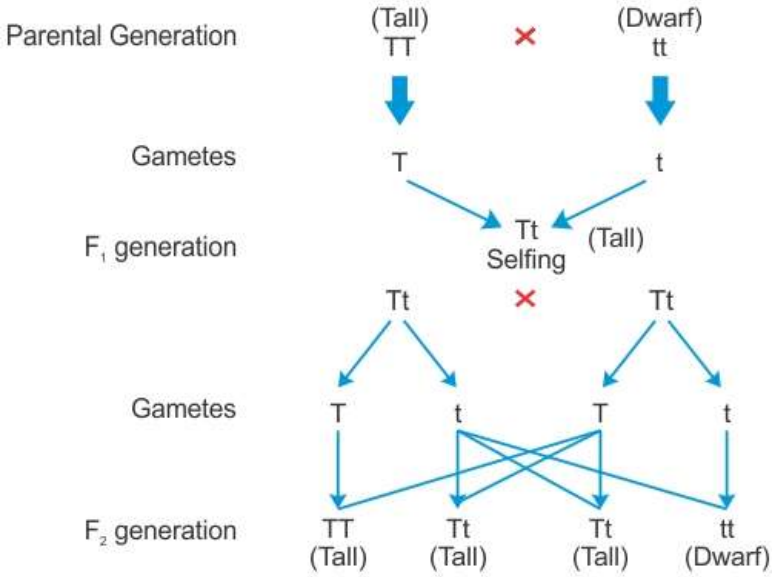
OR

Baking soda was added instead of baking powder which made the cake bitter in taste and flat in texture. Generally, Baking powder is added to breads and cakes to make them fluffy and soft.

- The main ingredients of baking powder are:
- Baking soda and an edible acid like tartaric acid.
- Baking soda (sodium hydrogen carbonate), when heated, releases CO_2 gas when it comes in contact with the batter's acidic component, which makes the cake fluffy and soft.
- Tartaric acid avoids the bitter taste by reacting with Na_2CO_3 formed by the heating of $NaHCO_3$.

29. Reflex action is an automatic and spontaneous response to a stimulus. The pathway taken by nerve impulses and responses in a reflex action is called a reflex arc. It consists of receptor, sensory nerve (afferent), spinal cord, motor nerve (efferent) and effector (muscles or glands).
Reflex arcs are evolved in animals because the thinking process of the brain is not fast enough. Reflex arcs enable the body to give quick responses to harmful stimuli so that the chances of damage to the body are decreased. It also prevents overloading of the brain, and so prevents its fatigue.
Several animals have very little or no complex neuronal networks needed for thinking. So, it is likely that reflex arcs have evolved as an efficient way of functioning in the absence of true thought processes. Even after complex neuronal networks came into existence, reflex arcs continue to be more efficient for quick responses.

30. The given cross is depicted below-



(a) In the F_1 generation, all the plants would be tall.

(b) Tall : Dwarf = 3 : 1

(c) Dwarf plants are not found in the F_1 generation but appear in the F_2 generation. This is because the trait for tallness is dominant over the trait for dwarfness. They suppress the expression of the recessive trait - dwarfness.

31.

(a) Having two eyes has the following advantages over having just one eye:

(i) Reduces the degree of parallax from our field of view.

(ii) Allows us to see farther into the distance with higher resolution.

(iii) Provides us with proper eyesight even if one of our eyes is damaged.

(iv) Gives organisms a wider field of view and the perception of depth.

(b) The iris controls the size of the pupil. Thus, when our eye encounters bright light, the iris contracts the pupil and protects the retina from damage.

(c) If a person is wearing spectacles of power +1 D, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, it can be concluded that he is suffering from hypermetropia or long-sightedness.

For a person wearing spectacles of power –1 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, it can be concluded that he is suffering from myopia or short-sightedness.

32.

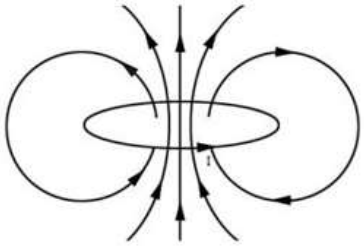
(a) The strength of the magnetic field (B) is inversely proportional to the radius of the circular loop (r).

$$B \propto \frac{1}{r}$$

(b) The strength of the magnetic field (B) is directly proportional to the number of turns in the coil (N).

$$B \propto N$$

(c) The magnetic field lines will be as shown below.



33.

(a) Factors on which the direction of force experienced by a current-carrying conductor placed in a magnetic field depend are:
(i) Direction of current and (ii) direction of magnetic field.

(b) The force acting on a current-carrying conductor placed in a magnetic field is maximum when the direction of the current is at right angles to the direction of the magnetic field.

(c) Because the proton beam is moving parallel to the direction of the magnetic field, no force acts on it.

SECTION – D

34.

(a) A is propanol, CH_3-CH_2-CH_2OH Propanol reacts with sodium to evolve hydrogen with a pop sound.

(b) B is propene, $CH_3CH=CH_2$
When compound A (propanol) is heated with concentrated sulphuric acid at 170°C, compound B is formed called propene. It is an unsaturated compound; hence, it decolourises bromine water.

(c) Propanol is converted to propene through dehydration reaction (loss of water).

$$CH_3CH_2CH_2OH \longrightarrow CH_3CH=CH_2 + H_2O$$

(d) C is propane, CH_3CH_2-CH_3
The compound C is propane ($CH_3CH_2CH_3$). Compound B (propene) adds one molecule of hydrogen in the presence of Ni as a catalyst to form compound C (propane).

(e) The conversion of propane to propene involves the addition of hydrogen; the reaction is known as hydrogenation.

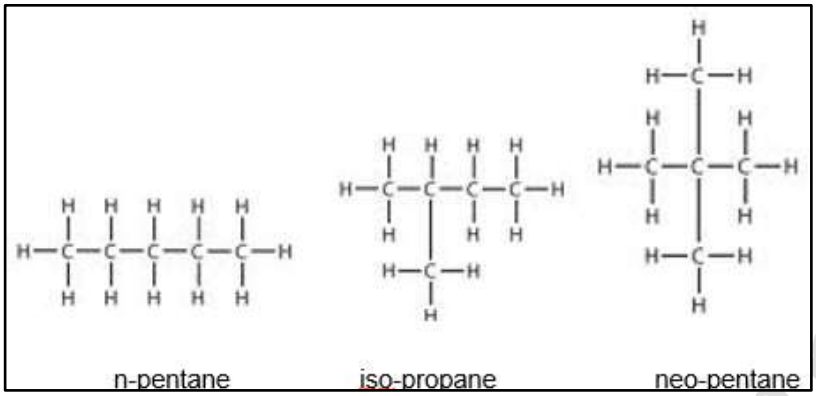
$$CH_3CH=CH_2 + H_2 \xrightarrow{Ni,\Delta} CH_3CH_2CH_3$$

OR

Butane and Isobutane are isomers of each other. This phenomenon is called Isomerism.

The compounds with identical molecular formula but different structural formula are called isomers and the property is known as isomerism.

Isomers of Pentane (C_5H_{12}):



Homologous series of C_5H_{12} is 'alkane'.

General formula: C_nH_{2n+2}

35.

(a)

(i) No spores will be formed on Slice 1 due to lack of moisture.

(ii) On Slice 2, fungal hyphae develop as white cottony mass and bear sporangia having spores due to the presence of favourable conditions of moisture and darkness.

(iii) Slice 3 will remain sterile and will not develop any spores due to low temperature inside the refrigerator.

(b)

(i) If egg is fertilized, it gets implanted in the uterine lining resulting in pregnancy.

(ii) If egg is not fertilized, it is shed out of the body along with blood causing menstruation.

OR

(a) TSH stands for Thyroid Stimulating Hormone.

(b) A 35-year-old woman with TSH level 6.03 mU/L indicates that she is suffering hypothyroidism. A high TSH level indicates that the thyroid gland is not making enough thyroid hormone. Iodised salt can be included in her diet to control this condition.

(c) Women are at greater risk for developing abnormal TSH levels during menstruation, while giving birth and after going through menopause.

(d) Low TSH level means that there is excess of thyroxine (hyperthyroidism) in the body secreted by the thyroid gland. So, the pituitary gland starts producing less TSH.

(e) Thyroid gland synthesises a hormone called thyroxine, which contains iodine.

36. From the given graph we can conclude that slope of wire A is greater than slope of wire B.

i.e., Resistance of wire A > Resistance of wire B (∵ Steeper the line higher will be its slope and resistance for all ohmic conductor)

Now, the resistance (R) of a wire is directly proportional to its length and inversely proportional to its area of cross-section (A).

i.e., $R = \frac{\rho \ell}{A}$

Resistance (R) ∝ Length (l) (∵ Material and thickness (area of cross section) of wire are constant)

Thus, for the given case, the resistance of A is more and so is its length.

OR

(a) Argon or neon gas is filled in electric bulbs.

These gases are used because they are inactive or inert. This prolongs the life of the filament.

(b) The property of a conductor because of which it opposes the flow of current through it is called resistance. The resistance of a conductor depends on:

(i) Length of the conductor: The resistance of a conductor is directly proportional to the length of the conductor.

(ii) Area of cross-section: The resistance of a conductor is inversely proportional to its area of cross-section.

(iii) Nature of the material of the conductor.

(iv) Temperature of the conductor: Resistance of all pure metals increases with temperature and *vice versa*.

The SI unit of resistance is ohm (Ω).

(c) I = 5 A, R = 12Ω

Heat energy produced, $H = I^2Rt = (5)^2 \times 12 \times t$

Thus, rate at which heat is generated is given as

$$\text{Rate} = \frac{H}{t} = 300 \text{ Joule/second}$$

Thus, the rate at which the heat is generated is 300 J/s.

SECTION - E

37.

(a)

(i) The nature of oxide A_2O_3 is amphoteric since it can react with both acid and alkali to form salt and water.

(ii) The nature of oxide BO is amphoteric since it can react with acid and alkali to form salt and water.

(b)

(i) Example of metal A is aluminium and oxide = Al_2O_3.

(ii) Example of metal B is zinc and oxide = ZnO.

OR

(b) Example of oxide like E_2O = Na_2O or K_2O.
The nature of this oxide is basic as the aqueous solution of this oxide turns red litmus blue.

38. Let B be the gene for dominant eye colour, and b be the gene for recessive eye colour.
The cross was made between parents having the same eye colour - black.
So, the possible genotypes of the parents would be either BB or Bb or bb.
Let us analyse the results obtained after crossing each of these parents.
Case I:

- Parents – BB × BB
- Gametes – B, B
- Progeny – BB

Case II:

- Parents – bb × bb
- Gametes – b, b
- Progeny – bb

Case III:

- Parents – Bb × Bb
- Gametes – B, b, B, b
- Progeny – BB, Bb, Bb, bb

However, after crossing both the parents, 75 pigs had black eyes and 25 of them had white eyes.
Hence, we can directly rule out case I and II since only one type of progeny is obtained in both these cases. Case III is applicable in the given cross.
And since 75 pigs had black eyes and 25 had white eyes, the gene for black eyes is dominant and the gene for white eyes is recessive.
Therefore,
(a) The possible genotype of the parent guinea pigs is Bb.
(b) The trait for black eye colour is dominant and the trait for white eye colour is recessive.
(c) 75 pigs had black eyes and 25 had white eyes. Therefore, the ratio of F_2 progeny obtained from the cross of Bb × Bb is 3 : 1.

OR

In guinea pigs, short hair is dominant to long hair.
Short hair – HH, Long hair – hh
This is an example of a monohybrid cross.
Genotypic ratio of F_2 progeny – 1 : 2: 1
Phenotypic ratio of F_2 progeny – 3 (short hair) : 1 (long hair)
Hence, out of 400 pigs in F_2 generation, 300 pigs would be short-haired, and 100 pigs would be long-haired.

39.

a) As the image has to be obtained on the screen Prabha must use concave mirror.

b) m = -v/u
v = - 60 cm
u = -15 cm
Thus,
Linear magnification of image produced is m = – 4

c) Negative sign indicates that image is real and inverted and value 4 which greater than one indicates that the image formed is enlarged or magnified.

OR

d) v = - 60 cm
u = - 15 cm
Thus,
v – u = -60 + (-15) = - 45 cm
The distance between image and object in the given case is 45 cm.