Solution
PRELIMINARY EXAM - I - SET 2
Class 10 - Science
Section A

1.

(c) $6CO_2 + 12H_2O + Chlorophyll + Sunlight \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

Explanation:

The summary equation of photosynthesis is

$6CO_2 + 12H_2O + Chlorophyll + Sunlight \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

Photosynthesis is a process by which green plants make their own food, e.g., glucose. CO_2 and H_2O in the presence of sunlight energy and chlorophyll in the presence of Oxygen gas is released during the process of photosynthesis.

2.

(b) Both maternal & Paternal DNA

Explanation:

As during fertilisation, sperm only gives nucleus, but ova gives nucleus as well as cytoplasm. Therefore, the mitochondrial DNA and other cytoplasmic factors are inherited directly from mother. there are some traits which are exclusively linked with Y- chromosome and they are inherited by the male child directly from father.

3. **(a)** A and B

Explanation:

Different essential nutrients like nitrogen, carbon, oxygen, and water are cycled and changed from one form to another in separate biogeochemical cycles in an ecosystem. The producers convert the solar energy received from the Sun into chemical energy and also fix up the nutrients from the soil, and make them available to the higher trophic levels in the ecosystem.

4. **(a)** (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)

Explanation:

- Phototropism refers to the movement of a plant toward a light source.
- Geotropism the growth of the parts of plants in response to the force of gravity.
- Hydrotropism the growth or turning of plant roots towards or away from moisture.
- Chemotropism may be defined as the movement or the growth of the organism in response to a chemical stimulus.

5.

(c) 10%

Explanation:

10%

6.

(d) Heterotrophs do not synthesise their own food

Explanation:

Heterotrophs either dependent on Phototrophs or other organisms for their food.

7.

(d) Change in amount of water in cells

Explanation:

Change in amount of water in cells

8.

(b) Both A and R are true but R is not the correct explanation of A.
Explanation:
Plasmodium reproduces asexually by multiple fission.

9.

(c) A is true but R is false.
Explanation:
A is true but R is false.

10.

Gamete	**Zygote**
The cells involved in sexual reproduction are called gametes, e.g. sperm (male) and ova(female)	The fusion of male and female gametes forms zygote during sexual reproduction
Gametes are unfertilised reproductive cells.	Zygote is fertilised egg or fertilised ovum.
The fusion of sperm and egg forms a fertilised ovum or zygote.	Zygote undergoes development and forms new organism.

Gametes are a prerequisite for the sexual reproduction. Both sperm and ova unite to form a zygote. Zygote further develops and forms an embryo which becomes a baby.

11. a. All interacting organisms in an area together with non living constituents of the environment form an ecosystem. Ecosystems can be terrestrial (land-based), aquatic (water-based), or a combination of both, and they provide essential services such as food production, water purification, climate regulation, and habitat provision for countless species.
    b. Forest/Pond/Terrestrial /any other
    c. Decomposers are present in ponds or lakes; whereas these are absent in an aquarium.

OR

The above statement can be supported by two facts -

- Recently, its been a trend to use disposable materials like cups, plates, spoons etc. in marriages and parties. These are usually made up of non biodegradable substances like plastic and styrofoam which eventually result in polluting our environment.
- Another example is the use of disposable plastic cups in trains. These leads to generation of a lot of plastic waste. However, they are being slowly replaced by paper cups to reduce the burden on the environment.

12. When an electrical signal reaches the axonal end of a neuron, it releases a chemical substance. This chemical diffuses towards the dendrite end of next neuron where it generates an electrical impulse or signal. Hence, the electrical signal is converted into a chemical signal at the axonal end. Since these chemicals are absent at the dendrite end of the neuron the electrical signal, cannot be converted into chemical signal.

13. a. Genotypes. Man ($I^A I^O$) Mother $I^B I^O$ and child $I^O I^O$.
    b. Blood group of the future offspring. A type, B type, O type and AB type. It is based on the following cross:

♀ \ ♂	I^A	I^O
I^B	$I^A I^B$	$I^B I^O$
I^O	$I^A I^O$	$I^O I^O$

14. a. Urea, Uric acid
    b. Glomerulus
    c. (Kidney) $\rightarrow$ Ureter $\rightarrow$ Urinary bladder $\rightarrow$ (Urethra)

15. i. If X chromosome of male sperm fuses with X chromosome of female ova, girl child is born.
    If Y chromosome of male sperm fuses with X chromosome of female ova, boy child is born.

ii. Because one is a normal sized 'X' while the other is short one 'Y'.

iii. i. During formation of germ cell / gametes the chromosome number is reduced to half.
ii. When two germ cells from two individuals combine to form a new individual, they restore the original number of chromosomes.

OR

Example 1: - The temperature at which fertilized eggs are kept determines whether the animals developing in the eggs will be male or female.

Example 2:

Snails - Individuals can change sex during their lifetime.

Reptiles

16. i. Scrotum (scrotal sacs) holds the testes in the human male.
ii. Penis releases the sperms in the female body.
iii. The ovary contains a mature egg.
iv. Semen is the fluid which keeps the sperms active.
v. Puberty is the period during which reproductive tissues begin to mature.

OR

Central - Brain and Spinal cord: The central nervous system consists of the brain and spinal cord. The brain is the control center of the nervous system and is responsible for processing sensory information, initiating voluntary movements, regulating involuntary functions (such as heartbeat and respiration), and higher cognitive functions (such as thinking, memory, and emotions).

Peripheral - cranial nerves and spinal nerves: The peripheral nervous system consists of all the nerves and ganglia (clusters of nerve cell bodies) outside of the brain and spinal cord. The PNS connects the central nervous system to the rest of the body, including muscles, glands, and sensory organs.

- **Protection of the Components of the Central Nervous System:**
- The brain is protected by the skull, a hard and bony structure that surrounds and encases the brain tissue, providing physical protection against external trauma.
- The spinal cord is surrounded by a series of protective membranes called meninges, which provide additional cushioning and support. The three layers of meninges are the dura mater (outer layer), arachnoid mater (middle layer), and pia mater (inner layer).
- **Signals Disrupted in Case of Spinal Cord Injury:**
- A spinal cord injury disrupts the transmission of nerve signals between the brain and the rest of the body, leading to various impairments depending on the location and severity of the injury.
- Motor signals: Damage to the spinal cord can result in paralysis or weakness of muscles below the level of injury, leading to loss of voluntary movement and control.
- Sensory signals: Spinal cord injury can also cause loss of sensation, including touch, temperature, and proprioception (awareness of body position and movement).

Section B

17.

(c) (i) and (ii)

Explanation:

(i) and (ii)

This reaction produces carbon dioxide gas. Carbon dioxide turns lime water milky and extinguishes a burning splinter.

Acid + Metal hydrogen carbonate $\rightarrow$ Salt + carbon dioxide + Water

18.

(c) Statement B is true; Statement A is false.

Explanation:

- The bromine water test is a test for unsaturated hydrocarbons. Ethane undergoes addition reaction and decolorizes bromine water. Similarly, ethyne also decolorizes bromine water.
- The mixture of water and alcohol is used in radiators of vehicles in cold countries. Alcohol is used for antifreeze mixture. Antifreeze is an additive that lowers the freezing point of a water-

based liquid.

19. **(a)** To absorb moisture
Explanation:
Anhydrous calcium chloride is used to absorb moisture or as a packaging aid to ensure dryness.

20. **(a)** (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)
Explanation:
- Ionic bonds are formed between cations and anions.
- Catenation is the linkage of atoms of the same element into longer chains. Catenation occurs most readily in carbon.
- Pyridine is added to alcohol to make it unsuitable for drinking.
- Most of the synthetic detergents are non-biodegradable. They cannot be decomposed by micro-organisms like bacteria.

21. **(d)** $FeSiO_3$
Explanation:
The sulphide ore of copper-containing iron is mixed with silica before heating in a reverberatory furnace. Iron oxide forms a slag of iron silicate ($FeSiO_3$).
The reaction is: $FeO + SiO_2 \rightarrow FeSiO_3$

22. **(c)** (i) and (iv)
Explanation:
(i) and (iv)

23. **(a)** blue
Explanation:
Turmeric is a natural indication that can help us determine if a given solution is acidic, basic, or neutral. If the pH is between 7.5 and 9.5, the turmeric paper turns reddish brown. As a result, the solution is straightforward. As a result, the Universal pH indicator will display the colour Blue or a little darker blue. Violet will not be present because violet is only seen in strongly alkaline bases.

24. **(d)** A is false but R is true.
Explanation:
Washing soda is sodium carbonate decahydrate, $Na_2CO_3 \cdot 10H_2O$.

25. a. The blue colour of the copper sulphate crystals turns to white.
b. Yes, we will notice water droplets in the boiling tube.
c. Copper sulphate crystals ($CuSO_4 .5H_2O$) have water of crystallization as the part of crystals which gets removed on heating.

26. Balanced chemical equations are as follow:
i. $P_4(s) + 10Cl_2(g) \longrightarrow 4PCl_5(s)$
ii. $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l) +$ Heat energy
iii. $C_6H_{12}O_6(s) + 6O_2(g) + 6H_2O \longrightarrow 6CO_2(aq) + 12H_2O(l) +$ Energy

OR

$2Mg + O_2 \rightarrow 2MgO$
$3Mg + N_2 \rightarrow Mg_3N_2$
(i) $X\ is\ MgO;\ Y\ is\ Mg_3N_2$
(ii) $MgO + H_2O \rightarrow Mg(OH)_2$

27. i. B is most reactive as it displaces all other metals from their respective salt solutions.
ii. B will displace copper from copper(II) sulphate, being a more reactive metal than it.
iii. B > A > C > D.

28. i. $\underset{35\ g}{PQ} \longrightarrow \underset{20g\ +\ ?}{P + Q}$

According to law of conservation of mass,
Mass of PQ = Mass of P + Mass of Q
∴ Mass of Q = (35 - 20)g = 15 g

ii. 2 moles of mercury (II) oxide produce 2 moles of mercury and one mole of oxygen gas.
$2HgO_{(s)} \longrightarrow 2Hg_{(l)} + O_{2(g)}$

iii. The law of conservation of mass is satisfied by a balanced chemical equation.

OR

12 and 6

29. The addition reaction can be seen only with unsaturated carbon compounds. One example of addition reaction is hydrogenation reaction, which is used to obtain ghee from vegetable oil.

e.g. $\underset{Ethene}{CH_2 = CH_2} + H_2 \xrightarrow[Ni]{200^0C} \underset{Ethane}{CH_3 - CH_3}$

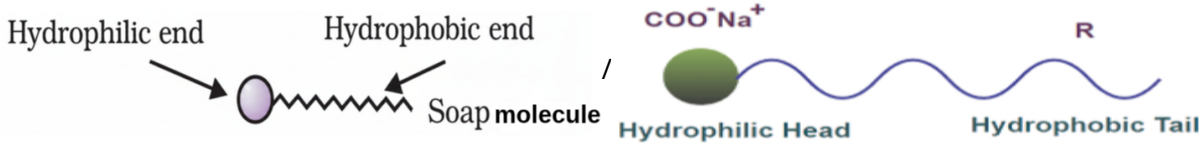
$\underset{(Unsaturated)}{Vegetable\ oil} \xrightarrow[200^0C]{H_2/Ni} \underset{(Saturated)}{Ghee}$

The rate of reaction increases in the presence of catalyst (Ni or Pt), they adsorb the hydrogen molecule over their surface thus increasing the rate of reaction.
In subsitution reaction, a reagent substitutes on atom or a group of atoms from the reactant instead of addition.

e.g. $CH_4 + Cl_2 \xrightarrow{Sunlight} Ch_3Cl + HCl$

OR

- Soaps are sodium or potassium salts of long chain carboxylic acids.



soap molecule consists of a hydrophobic (water repelling) end and a hydrophilic (water loving) end.

- Most dirt is oily in nature, oil does not dissolve in water. The ionic-end (hydrophilic) of soap interacts with water while the carbon chain (hydrophobic) interacts with oil. The soap molecules react with dirt, thus form structures called micelles. This forms an emulsion in water. The soap micelle thus helps in pulling out the dirt in water and we can wash our clothes clean
- Hard water contains salts of Ca and Mg, which reacts with soap to form scum (an insoluble substance) and no foam is formed
- we can overcome this problem by using detergents as cleaning agents. / By removing hardness of water.

Section C

30.

(c) All of these
Explanation:
All the given statements are correct.

- The speed of all colours is the same in air or vacuum i.e. 3×10^8 ms^{-1}. But the speed of all colours is different in a denser medium.
- The refractive index has no unit since it is a ratio. The absolute refractive index of a medium (n_m) is given by $n_m = \frac{c}{v}$ where c is the speed of light in air, and v is the speed of light in the medium.

31. **(a)** p, y, z
Explanation:
p, y, z

32.
(d) A is false but R is true.
Explanation:
When current flows through a solenoid, the currents in the various turns of the solenoid are parallel and in the same direction. Since the current flowing through parallel wires in the same direction lead to force of attraction between them, the turns of the solenoid will also attract each other and as a result the solenoid tends to contract.

33. The brightness of the image in the camera is:
a. directly proportional to time of exposure(t).
b. directly proportional to the square of diameter of aperture of the lens system (i.e. light gathering power of the objective).
c. inversely proportional to the square of focal length of the lens system.
d. is inversely proportional to the square of the lateral magnification. i.e. Image Brightness $\propto (N_A/M)^2$; where $\mathbf{N_A}$ is the objective numerical aperture and **M** is the magnification.

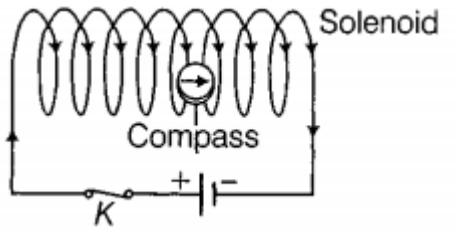
34. Rate at which heat is developed in the heater is its power.
$P = I^2R = (15)^2(8) = 225 \times 8$ or P = 1800W or Js^{-1}
1,800 J of heat is developed per second.

OR

Here V = 220 volts; R = 440Ω
Now $I = \frac{V}{R} = \frac{220}{440} = 0.5\ A$
Heat energy produced in 30s = $\frac{V^2}{R}T = \frac{(220)^2 \times 30}{440} = 3300J$

35. i. The magnetic field will be acting in vertically downward direction in accordance with Fleming's left-hand rule. [Direction of the current should be considered in a direction opposite to the direction in which the electrons move].
ii. Current will definitely be induced in coil B if current is changed in coil A. If current in A is increased, the induced current in B will be in direction opposite to that in A. If current in A is decreased, induced current in B will be in same direction as in A. This change in magnetic field lines around coil B induces an electric current in it. This process is known electromagnetic induction.

36. i. A: pulmonary artery
B: pulmonary vein
C: aorta
D: vena cava
ii.
- **Function of A:** Carries deoxygenated blood from heart to lungs.
- **Function of C:** Transports oxygenated blood from heart to all parts of the body.

37. i.


ii. The direction of the magnetic field inside the solenoid always points from the induced South pole towards the induced North pole.

38. i. Since the resistance in arm B are connected in series.
So, $R_B = 5\Omega + 10\Omega + 15\Omega$
$R_B = 30\Omega$

ii. Total resistance in arm C

$R_C = 10\Omega + 20\Omega + 30\Omega$

$R_C = 60\Omega$

Now as arm B and arm C are in parallel

Equivalent resistance $\frac{1}{R} = \frac{1}{R_B} + \frac{1}{R_C}$

$\frac{1}{R} = \frac{2+1}{60} = \frac{3}{60}$

$R = 20\Omega$

iii. Total resistance in arm A

$R_A = 5\Omega + 15\Omega + 20\Omega$

$R_A = 40\Omega$

Now, Equivalent resistance of circuit

$R_{eq} = R_{eq} + R$

$R_{eq} = 40 + 20 = 60\Omega$

By ohm's law

V = IR

$I = \frac{V}{R} = \frac{6}{60}$ = 0.1 A

OR

If arm B is removed

Equivalent resistance in circuit

$R_{eq} = R_A + R_C$

$R_{eq} = 40 + 60 = 100\Omega$

From ohm's law

V = IR

$I = \frac{V}{R} = \frac{6}{100}$ = 0.06 A

39. Since the image formed is real, hence an inverted image is formed.

size of image, h_2 = - 3 cm, size of object h_1 = + 2 cm.

Magnification $m = \frac{h_2}{h_1} = \frac{-3}{2} = -1.5$. Also $m = \frac{-v}{u}$ or $v = -mu$ ..... (i)

Here v = - 16 cm (*u* is always negative)

Substituting in (i), we have *v* = - (-1.5) (-16) = - 24 cm. or *v* = - 24 cm.

Image is formed 24 cm to the left of the mirror (Negative sign – Image is towards left of mirror)

To calculate focal length. Here *u* = = 16 cm, *v* = - 24 cm, *f* = ?

Using $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ or $\frac{1}{f} = -\frac{1}{24} - \frac{1}{16} = \frac{-2-3}{48} = -\frac{5}{48} or\ f = -\frac{48}{5} = -9.6\ cm$

Negative focal length indicates that the mirror is concave.

OR

a. Power of a lens is the Ability of a lens to diverge or converge light rays and SI unit of Power – diopter (D).

Type of lens whose power is negative is Concave lens.

b. Position of object:

i. Beyond $2F_1$

ii. At 2 F_1

iii. Between $2F_1$ and F_1

c. Labelled ray diagram -