SOLUTIONS

SAMPLE PAPER - 2

SECTION - A

1. *(a) (I) and (III)*

Explanation: Hybridisation is the act of performing a cross between two genetically separate plants of the same or different species. Therefore, statement (I) is true.

If the two types are different, the cross is referred to as intervarietal hybridization, otherwise, intravarietal hybridization (if varieties are same). Thus, statement (II) is incorrect.

By altering the plant's DNA, introducing desirable genes results in genetically engineered crops. The goal is to give the plant a new characteristic that does not arise naturally in the species. As a result, statement (III) is true.

Intervarietal hybridisation refers to plant cross-breeding in which the parent plants are from the same species but a different variety. A cross breed between two types of the wheat plant, for instance. Despite being diverse variations, they are all members of the same species. As a result, statement (IV) is incorrect.

2. *(b) Glass of water and beaker containing nitrogen.*

Explanation: Iron nails are solid so they have a fixed shape.

Water in glass is liquid and beaker containing nitrogen is gas in nature so both of these, don't have definite shape.

3. *(d) Both the muscles show involuntary movements.*

Explanation: Movement of muscles of heart for pumping blood as-well-as movement of food inside the intestine are not controlled by our will. They function on their own and are called involuntary muscles.

4. *(a) into, swell*

Explanation: A hypotonic solution is one with a lower concentration of solutes. Water molecules move from the outside to the inside of the cell through the cell membrane. Endosmosis is the process through which a cell acquires water and swells up.

5. *(b) All isotopes are neutral since they have one electron and one proton.*

Explanation: The isotopes of the hydrogen atom are electrically neutral because the number of protons and the number of electrons is equal. They both cancel out their charges resulting in the net charge zero.

6. *(b) Acceleration becomes half*

Explanation: We know that,

$$\text{Force} = \text{mass} \times \text{acceleration}$$

$$F = ma$$

$$a = \frac{F}{m}$$

Mass is doubled and force remains same

$$F = 2ma'$$

$$a' = \frac{F}{2m}$$

$$a' = \frac{a}{2}$$

Acceleration becomes half.

7. *(a) cuticle*

Explanation: The epidermis of desert plants has a thick layer of cutin called cuticle. It is a waxy, waterproof substance found on the surface of leaves that serves to minimise water loss due to evaporation while, it also protects the plant from infections and mechanical damage.

8. *(a) Sound will be louder but pitch will not be different.*

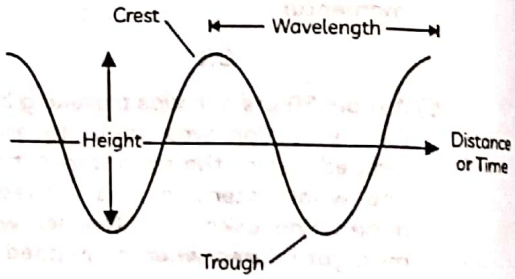
Explanation: When a mechanical piano key is struck harder, the sound becomes louder because it vibrates with more amplitude, but the pitch does not change because it is independent of how hard the key is struck.

9. *(c) BD*

Explanation: A sound wave's wavelength is the distance between successive crests and troughs. As a result, the distance covered by one crest or trough is half the wavelength. The points BD are half the wavelength in the given.

Related Theory

Waves have crests (or peaks) and troughs that move. A crest is the highest point reached by the medium, while a trough is the lowest point reached by the medium. A crest is a point on a wave where the medium's displacement is at its maximum. If the displacement of the medium at a given position on the wave is the smallest, that location is called a trough.



10. *(d) $d_1 < d_2 < d_3$*

Explanation: When a rigid object is partially or completely submerged in a fluid, there is a buoyant force that acts upward on the object that is equal to the weight of the fluid that is displaced by the object.

Three liquids with different densities are present in this situation.

$$\frac{1}{9} = 0.11$$

$$\frac{2}{11} = 0.18$$

$$\frac{3}{7} = 0.43$$

These values are the volume outside of liquids for various densities d_1, d_2 and d_3 respectively. Thus, for d_3 the buoyant force is highest and for d_1 is minimum. The densities of the liquids are in the order $d_1 < d_2 < d_3$ because buoyant force is proportional to density.

11. *(d) 17.2 m*

Explanation: The sound sensation lasts roughly 0.1 second in our brain. To hear a distinct echo, the time delay between the original sound and the reflected sound must be less than 0.1 second.

At a particular temperature, say 35°C, the speed of sound in air is 344 m/s.

The sound must travel to the impediment and then reflect back to the listener's ear after 0.1 seconds.

As a result, the total distance travelled by sound from the source to the reflecting surface and back is $344 \times 0.1 = 34.4$ m.

So, the obstacle's minimum distance from the source of sound must be half of this distance in order to hear the echo i.e., 17.2 metres.

12. (b) $\frac{u^2}{2g}$

Explanation: A body thrown vertically upward with velocity u will have a final velocity v zero at the highest height h.

Final velocity, $v = 0$

Acceleration, $a = -g$

Height, $s = h$

Using third equation of motion,

$$v^2 = u^2 + 2as$$
$$0 = u^2 + 2(-g)(h)$$
$$u^2 = 2gh$$
$$h = \frac{u^2}{2g}$$

13. (b) (A) – (iv), (B) – (iii), (C) – (i), (D) – (v), (E) – (ii)

Explanation:

(A) Matter – (iv) Made of small particles,

(B) Condensation – (iii) Water vapour becomes liquid.

(C) Evaporation – (i) Rapid vaporisation of a liquid.

(D) Humidity – (v) Amount of vapour present in air.

(E) Freezing – (ii) Liquid turns into a solid when its temperature is lowered.

14. (c) *The mango and Earth are attracted to each other.*

Explanation: The mango attracts the Earth, and the Earth attracts the mango with the same gravitational force (according to 3rd law of motion).

15. (b) *Intercalary meristem*

Explanation: The intercalary meristem is responsible for the rapid extension of a bamboo stem. At the nodes of hollow stems or culms (in sugarcane and bamboo), intercalary meristems allow for fast stem extension. They are found at the base of the stem or leaf internodes.

These are made up of remains of the apical meristem that were found at the nodes and internodes of the stem or leaf.

Related Theory

The cells in the intercalary meristem area divide quickly, assisting in the elongation and growth of plants at nodes and internodes (stems and leaves), as-well-as the longitudinal growth of grass stems and leaves.

16. (b) 0.5 hr

Explanation: Given, Average speed,

$v_{av} = 4$ km/h

Distance, $s = 2$ km

$$\text{Average Speed} = \frac{\text{Total Distance travelled}}{\text{Total Time taken}}$$

$$t = \frac{s}{v_{av}}$$
$$t = \frac{2}{4}$$
$$= 0.5 \text{ hr}$$

17. (a) *Both A and R are true and R is the correct explanation of A.*

Explanation: The atomic mass of an element indicates how many times an atom of that element is heavier than a C-12 atom.

18. (a) *Both A and R are true and R is the correct explanation of A.*

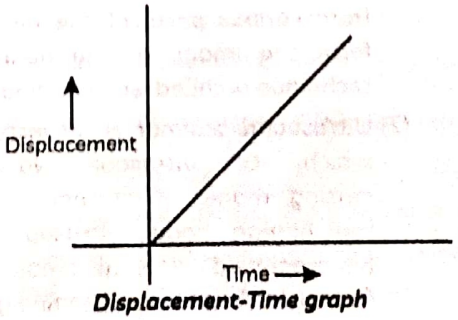
Explanation: In a gas, sound velocity is proportional to the square root of the absolute temperature $v = \sqrt{\frac{\rho RT}{M}}$. Because the temperature of a hot summer day is higher than the temperature of a cold winter day, sound would travel faster on a hot summer day than on a cold winter day.

19. (b) *Both A and R are true and R is not the correct explanation of A.*

Explanation: Cell was discovered by Robert Hooke in 1665. The fluid content of the cell consisting of nuclear material and cytoplasm is called protoplasm. But second statement is not an explanation of first.

20. (a) *Both A and R are true and R is the correct explanation of A.*

Explanation: From the given graph, it is clear that the body is travelling equal distance in equal intervals of time so a straight line is obtained.



Displacement-Time graph

SECTION - B

21. (A) Endoplasmic reticulum is called transporting channel of the cell because it connects the cell membrane to the nuclear membrane. Since, ER posses substances to various parts of the cell it functions as an internal delivery system. The endoplasmic reticulum membrane transports secretory proteins, primarily glycoproteins.

(B) Nucleus is called the control room of the cell because it performs two main functions:

(1) It contains hereditary information for structure, reproduction, development, metabolism and behaviour.

(2) It directs the synthesis of proteins and enzymes which governs cellular activities.

Related Theory

Nucleus is also known as the brain of the cell.

22. (A) Some elements lose or gain electrons to attain stable state or nearest noble gas configuration or lowest energy state.

(B) As the atomic number of phosphorus is 15.

So, the electronic configuration is 2, 8, 5.

OR

(A) The only parameter needed for the identification of any element is the number of protons. As every element has their unique atomic number and we know atomic number is equal to the number of protons.

(B) The given statement is not correct.

As the number of protons is never greater than the number of neutrons.

The number of neutrons can be equal to or greater than the number of protons but the number of protons is equal to the number of electrons for an atom since it is neutral.

23. (A) This is due to the fact that light travels much faster than sound. Light travels at a speed of 3×10^8 m/s.

(B) (1) Ultrasonic waves are made to reflect from various parts of the heart and form the image of the heart. This technique is called 'echocardiography'.

(2) Ultrasound scanner is an instrument which uses ultrasonic waves for getting images of internal organs of the human body. Ultrasound may be employed to break small stones formed in the kidneys into fine grains.

24. The moon's circular motion around the Earth is caused by the centripetal force provided by the Earth's gravitation. The moon will begin to move in a straight line in the same direction it was moving at the moment when the Earth's gravity abruptly vanishes. The moon will be travelling along the tangent to the circular orbit at that time.

OR

No, these packets do not take the same amount of time to reach the Earth's surface. The Earth isn't a perfectly round globe. The value of 'g' gets greater at the poles than at the equator as the Earth's radius increases from the poles to the equator. As a result, the package falls more slowly at the equator than at the poles. Therefore, when the packet is dropped at the equator, it will stay in the air for a longer period of time.

Related Theory

Due to the fact that the Earth is not perfectly spherical, the value of 'g', acceleration due to gravity changes from place to place.

As it is flattened at the poles, the value of g is highest there and it is lowest near the equator.

The value of 'g' increases as we move closer to poles.

25. Sea water is a combination of water, salts and a variety of suspended contaminants. Aside from them, it also has a lot of gases dissolved in it. Sea water is categorised as a homogeneous mixture because it contains a mixture of many dissolved gases and it is also categorised as a heterogeneous mixture because it contains salt and suspended contaminants.

26. (A) When immersed in a bucket of water, wood will float since its density is lower than that of water.

(B) $$F = G\frac{Mm}{d^2}$$

The law is universal in the sense that it is applicable to all bodies, whether the bodies are big or small, whether they are celestial or terrestrial.

SECTION - C

27. (A) $W_H : W_O = 1 : 8$ (in water molecules)

1 gram of hydrogen equals 8 grams of oxygen.

As a result, the quantity of oxygen for 3 g of hydrogen = 3 × 8 = 24 g.

Hence, 24 grams of oxygen would be needed to complete the reaction using 3 grams of hydrogen gas.

(B) (i) H_2S molecule has two hydrogen atoms and one sulphur atom. So, hydrogen sulphide (H_2S) has total 3 atoms.

(ii) PO_4^{3-} ion has one phosphorus atom and four oxygen atoms. So, phosphate ion $\left(PO_4^{3-}\right)$ has a total of 5 atoms.

28. (A) Mitochondria helps in the oxidation of food to release energy in the form of ATP.

These ATP molecules act as energy currency and are transported to various parts of the cell requiring energy. This process is also called cellular respiration.

(B) Vacuole is an organelle that serves as a 'storage sac' of the cell. It is found in both plant and animal cells. It is a membrane-bound organelle. The major ingredient of the vacuole is water, which contains various organic and inorganic constituents.

(C) During the disturbance in cellular metabolism, the lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are called suicidal bags of the cell.

29.

Parameter	Evaporation	Boiling
Temperature	Occurs at any temperature.	Occurs at fixed temperature.
Speed	Occurs at low speed.	Occurs at high speed.
Bubble formation	Bubbles are not formed.	Bubbles are formed.
Method of evaporation	Evaporation takes place only at the surface.	Evaporation takes place throughout the mass of liquid.
Heat supply	Heat is taken from surroundings.	External supply of heat is needed.

(Any three)

OR

Characteristics	Sol	Solution	Suspension
Mixture type	Heterogeneous	Homogeneous	Heterogeneous
Particle size	$10^{-7} - 10^{-5}$ cm	Less than 1 nm	More than 100 nm
Tyndall effect	Exhibits the Tyndall effect	Does not exhibits the Tyndall effect	Effect may or may not be exhibited. Depends on the type of mixture.
Appearance	Usually glassy and clear (Transparent)	Unclouded and clear (Translucent)	Cloudy and opaque
Visibility	Not visible	Visible with an ultramicroscope	Visible with the naked eye
Diffusion	Very slow diffusion	Rapid diffusion	No diffusion takes place

30. (A) Sclerenchyma can be found in the coconut husk. Sclerenchyma is a type of dead-simple permanent plant tissue characterised by thickened lignified cell walls that provide mechanical support to the plant as well as the ability to be waterproof. As a result of its thicker, lignified cells, the coconut husk is extremely rigid. Pulling the coconut husk out of such cells is quite difficult.

(B) Blood helps in the transportation of oxygen, nutrients, waste products and hormones. All the substances present in the body are mainly transported by the blood only.

31. (A) An ion is a charged particle and can be negatively or positively charged. A negatively charged ion is called an 'anion' and the positively charged ion is called a 'cation'.

(B) The law of conservation of mass states that mass in an isolated system is neither created nor destroyed by chemical reactions or physical transformations. According to the law of conservation of mass, the mass of the products in a chemical reaction must be equal the mass of reactants.

(C) On heating the powder, it will look char (partially burnt) and become black, if it is sugar. Alternatively, the powder may be dissolved in water and checked for its conduction of electricity. If it conducts, it is salt.

32. (A) Given: Initial velocity, $u = 0$ m/s

Final velocity, $v = 72$ km/h

$$= 72 \times \frac{5}{18} = 20 \text{ m/s}$$

Time = 5 min = 5 × 60 = 300 s

As we know that,

$$v = u + at$$

$$\Rightarrow \quad v - u = at$$

$$20 = a(300)$$

(B) Distance traveled,

$$s = ut + \frac{1}{2}at^2$$

$$= 0 \times 300 + \frac{1}{2}\left(\frac{1}{15}\right)(300)^2$$

$$= 3000 \text{ m}$$

Distance traveled by train for attaining this velocity is 3 km.

33. (A) Plant roots contain leucoplast, which are colourless plastids that serve as food storage.

Leucoplasts are found in most of the plant's non-photosynthetic sections, such as the roots. Depending on the needs of the plants, they serve as storage sacs for carbohydrates, lipids, and proteins.

(B) Plant leaves contain green pigment chlorophyll which aids in photosynthesis.

The major pigment that absorbs light during photosynthesis and gives plants their green colour is chlorophyll.

(C) Multicoloured chromoplasts are found in flowers and fruits to attract pollinators.

Carotene and xanthophylls are found in the chromoplasts. They give flowers and fruits a distinct colour, and aid pollination and seed dispersal.

SECTION - D

34. (A) Atomic mass number = Proton + Neutron

Atomic mass number of A = (6 + 6) = 12

Atomic mass number of B = (6 + 8) = 14

(B) The two elements A and B are isotopes because their nuclei have the same number of protons.

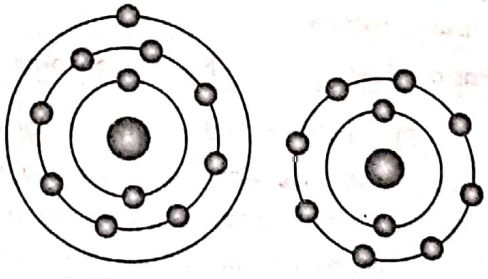
But they have different mass number, though because they have different number of neutron.

(C) The element is Carbon and C-12, C-14 are its isotopes.

(D) Electronic configuration of carbon is 2, 4.

OR

(A)



Sodium Atom Sodium Ion

The atomic number of the Sodium atom is 11.

No. of protons = No. of electrons = 11, whose electronic configuration is 2, 8, 1.

Sodium Ion is a positively charged ion (Na^+) that is formed by losing one electron from the outermost shell. The number of electrons is 10 whose electronic configuration is 2, 8.

As we know that atomic number is equal to a number of protons and sodium atoms and sodium ions contain the same number of protons. Therefore, the atomic number of both is 11.

(B) Let the percentage of ${}^{12}_{6}Y$ be x and the percentage of ${}^{14}_{6}Y$ be $100 - x$.

$$\left[12 \times \frac{x}{100}\right] + \left[14 \times \frac{100 - x}{100}\right] = 12.2$$

$$\frac{12x}{100} + \frac{1400 - 14x}{100} = 12.2$$

$$\frac{12x + 1400 - 14x}{100} = 12.2$$

$$12x + 1400 - 14x = 12.2 \times 100$$

$$1400 - 2x = 1220$$

$$-2x = 1220 - 1400$$

$$-2x = -180$$

$$x = \frac{180}{2}$$

$$x = 90\%$$

Therefore, a percentage of ${}^{12}_{6}Y = 90\%$

Percentage of ${}^{14}_{6}Y = 10\%$

35. (A) Given:

Both the particles have same momentum (p). Therefore, heavier particle Mv = Lighter particle mv'

To find ratio of kinetic energies:
Let the heavy and light objects have mass M and m and having speed v and v' respectively and M > m. The ratio of kinetic energy of both the particles are shown here.

$$\frac{KE}{KE'} = \frac{\frac{1}{2}Mv^2}{\frac{1}{2}mv'^2}$$

(Multiplying by M (or) m on both sides)

$$\frac{KE}{KE'} = \frac{\frac{M^2v^2}{2M}}{\frac{m^2v'^2}{2m}}$$

$$\frac{KE}{KE'} = \frac{\frac{p^2}{2M}}{\frac{p^2}{2m}}$$

$$\frac{KE}{KE'} = \frac{m}{M}$$

Since $M > m$

$$\frac{m}{M} < 1$$

So,

$\therefore KE < KE'$

Therefore, light particle m has more kinetic energy than that of heavier particle M.

(B) Kinetic energy is mathematically expressed as

$$KE = \frac{1}{2}mv^2$$

Momentum, mathematically expressed as:

$$p = mv$$

Where m is the mass
v is the velocity
p is the momentum
Multiply and divide R.H.S by m

$$KE = \frac{1}{2}mv^2 \times \frac{m}{m}$$

$$KE = \frac{1}{2}\frac{m^2v^2}{m}$$

$$KE = \frac{1}{2}\frac{(mv)^2}{m}$$

$$KE = \frac{1}{2}\frac{p^2}{m}$$

The given equation shows the relation between kinetic energy and momentum of a moving object.

Related Theory

- *The virtue of an object's mass is its momentum. The product of mass and velocity is what it is called. It's a vector quantity.*
- *The kinetic energy of an object is the energy associated with it when it is moving. "The energy required by a body to accelerate from rest to a stated velocity," according to the definition. It's a vector quantity.*

OR

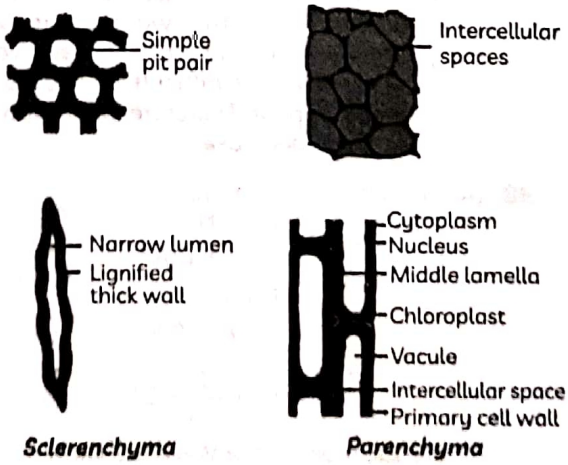
(A) This law states that energy can neither be created nor be destroyed; it can only be transformed from one form to another. Both before and after the transformation, the overall amount of energy is constant.

(B) In hydroelectric power plant, potential energy of water reservoir is converted into electric energy.

(C) A ball has only potential energy at a certain height. When it is dropped, it gradually picks up speed as it falls due to gravity. As a result, its potential energy becomes kinetic energy.

36.

S. No.	Sclerenchyma	Parenchyma
(1)	It is composed of dead cells.	It consists of living cells.
(2)	Its walls are thick.	It consists of thin cell walls.
(3)	Cell wall is made up of complex polymer lignin.	Cell wall is made up of cellulose.
(4)	It provides strength to the plants.	It stores nutrients and water in the stem and roots.
(5)	It is found in roots and veins of leaves.	It is found in soft parts of the plants, e.g., cortex of roots.



Sclerenchyma *Parenchyma*

OR

(A) The animal tissue shown in the figure is squamous epithelium.

(B) Figure labelling is as follows:

(i) Nucleus

(ii) Cytoplasm

(iii) Cement substance

(iv) Basement membrane

(C) Squamous epithelium cells have an irregular, flat structure that resembles floor tiles to form a compact structure. It is found in the mouth, nose, oesophagus, alveoli and lining of blood vessels. It also protects the skin and the tongue.

It protects against mechanical damage, germ invasion, drying and chemicals. Filtration happens by the formation of a selectively permeable membrane.

(D) Different types of epithelial tissues are:

(1) Cuboidal epithelium

(2) Columnar epithelium

(3) Ciliated epithelium

(4) Glandular epithelium

(5) Squamous epithelium

SECTION - E

37. (A) (i) Group 1 represents the solid state.

Group 2 represents the liquid state.

Group 3 represents the gaseous state.

(ii) When compared to liquids and gases, solids usually have the highest intermolecular forces. Solids are incompressible and have a high density because the particles are densely packed.

(B) (i) The group (3) is easiest to break, because the force of attraction between finger to finger is very less compared to group (1) and group (2).

(ii) Air particles have a lot of space between them. Wood, on the other hand, has a small amount of space between its particles. It is also stiff in nature. As a result, we can easily move our hands in the air, but we can't do the same with a solid block of wood.

OR

(B) (i) Cooling occurs due to evaporation. This is because when the liquid vaporises, it absorbs the latent heat of vaporisation from the other substances that it comes into contact with. These substances loses heat and cools. Therefore, evaporation causes cooling.

(ii) If the humidity is high, the air is already saturated with water vapour. It contains a lot of water vapour. Therefore, it is difficult to absorb more water vapour. Therefore, the evaporation rate will decrease.

38. (A) From the given graph,

$F = 1\ N$

$a = 0.5\ m/s^2$

$F = ma$

$1 = m \times 0.5$

$$m = \frac{1}{0.5} = 2\ kg$$

Hence, mass of the Volvo is 2 kg.

(B) We know that,

Force = mass × acceleration

Initial mass:

$$m_1 = \frac{F}{a}$$

Final mass: $m_2 = \frac{2F}{a/2} = \frac{4F}{a}$

$$\frac{m_2}{m_1} = \frac{4F/a}{F/a}$$

$= 4 : 1$

(C) The momentum is also doubled.

The momentum of an object or body is defined as the product of mass and velocity and has the same direction as that of the velocity. It is symbolised by 'p'. Therefore, Momentum = mass × velocity.

$$p = m \times v$$

OR

(C) Teacher replied that it is dangerous to jump from a moving bus since inside the train, man's body was in the state of motion with the train. When he jumps out of a moving train, his feet touch the ground and the lower part of the body comes to rest suddenly while, the upper part remains in motion and continues to move forward due to inertia of motion. As a result, he fell downward and got injured.

39. (A) The Blue Revolution programme focuses primarily on increasing the output and productivity of inland and offshore fisheries and aquaculture.

(B) The majority of the fish that were caught were used commercially and were hardly ever consumed by people. The husbandry and farming of economically significant aquatic species was therefore developed as a substitute technique to boost fish productivity. This is referred to as aquaculture.

(C) **Merits:** Fish meat is produced by fish culture and is a highly nutritious diet that contains vitamins, beneficial fat, and the most easily absorbed protein.

Demerits: Through fish culture, more selectively raised fish are produced while less profitable fish are discarded, endangering biodiversity and fish gene banks.

Related Theory

- *Other merits of fish culture system:*
  (1) *We have access to the seafood we want whenever we want it.*
  (2) *A high quantity of fish can be produced from a small space using suitably enhanced fish culture procedures.*
  (3) *Food-related issues can be partially resolved.*

OR

(C) (i) The third largest fish producer in the world is India. Rohu (*Labeo rohita*) and Catla (*Catla catla*) are two fishes, raised in culture fisheries in India. In addition to these fish, India is a major producer of Mrigala (*Cirrhinus mrigala*).

(ii) Selective breeding and keeping livestock are considered to be parts of animal husbandry, controlled cultivation, management and production of domestic animals including improvement of the qualities taken into consideration and are desirable for human being. Animal husbandry is significant source of income for many farmers.