

MT

2014 ___ ___ 1100

Seat No.

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MT - SCIENCE & TECHNOLOGY (72) - PRELIM II - PAPER - 3

Time : 3 Hours

(Pages 5)

Max. Marks : 80

Note :

- (i) All questions are compulsory.
- (ii) All questions carry equal marks.
- (iii) Draw neat and labelled diagrams wherever necessary.

SECTION - A

Q.1. (A) Answer the following sub-questions :

5

(1) **Find the odd man out :**

Myopia, Hypermetropia, Colour blindness, Presbyopia.

(2) **Fill in the blanks :**

(i) The law used by Newlands to arrange elements is called

(ii) Scientific evidence reveals that stratosphere ozone is being destroyed mainly by chlorine atoms of molecules.

(3) **State whether the following statements are true or false.**

(i) A substance having pH value 7 will have effect on litmus paper.

(ii) The unit of potential difference is ampere.

- (4) An image is formed 5 cm behind a convex mirror of focal length 10cm. At what distance is the object placed from the mirror ?
- (5) Distinguish between : Acid and Base.
- (6) Explain the following chemical reaction with the help of balanced equation : Iron reacts with dilute hydrochloric acid.

Q.3. Attempt any FIVE of the subquestions : 15

- (1) What adverse effect does ozone depletion have?
- (2) Define 1 Ampere and Solve : A current of 0.2 A is flowing through a bulb for 5 minutes. Find the charge that is flowing through the circuit.
- (3) Define refraction and state the laws of refraction.
- (4) Define magnetic field and state the characteristics of magnetic lines of force.
- (5) What are the steps of writing a chemical equation?
- (6) Explain Dobereiner's law of triads giving any one example.

Q.4. Attempt any ONE of the following : 5

- (1) Explain myopia with its correction.
- (2) Write a short note on indicators with proper example.

SECTION - B

Q.5. (A) Answer the following sub-questions : 5

- (1) Balanced the following chemical reaction.
$$\text{Al} + \text{H}_2\text{O} \rightarrow \text{Al}_2\text{O}_3 + \text{H}_2\uparrow$$
- (2) **Fill in the blanks :**
 - (i) Pure gold is alloyed with or to make ornaments.
 - (ii) Electricity generated by renewable sources of energy is called

(3) **Define :**

- (i) Saturated hydrocarbon.
- (ii) Eco-efficiency.

Q.5. (B) Rewrite the following statements by selecting the correct options : 5

(1) is the general formula of alkene.

- (a) C_nH_{2n}
- (b) C_nH_{2n+2}
- (c) C_nH_{2n-2}
- (d) C_nH_{n-2}

(2) is the hardest substance and has the highest melting and boiling points.

- (a) Iodine
- (b) Sulphur
- (c) Diamond
- (d) Phosphorus

(3) The process of absorption of water into raisins occurs through its membranes. This process is known as

- (a) diffusion
- (b) absorption
- (c) adsorption
- (d) osmosis

(4) To observe stomata in a dicot leaf, we must prepare a slide by taking

- (a) the crushed leaf
- (b) the upper epidermis of the leaf
- (c) the lower epidermis of the leaf
- (d) the central part of the leaf

(5) is not essential for photosynthesis.

- (a) Oxygen
- (b) Carbon dioxide
- (c) Light
- (d) Chlorophyll

Q.6. Attempt any FIVE of the following : **10**

- (1) What happens to the food in the large intestine ?
- (2) Draw a neat and labelled diagram of V.S. of human brain.
- (3) Distinguish between : Voluntary movements and Involuntary movements.
- (4) Short note on Regeneration.
- (5) Distinguish between : Diamond and Graphite.
- (6) Explain the following chemical reaction with the help of balanced equations : Calcium reacts with cold water.

Q.7. Attempt any FIVE of the following : **15**

- (1) Explain thermit reaction with the help of suitable example.
- (2) Write short note on homologous series.
- (3) Which are the different parts of the human nervous system?
- (4) What is the three 'R mantra? Write its significance.
- (5) Many robins died in Illinois in USA.
- (6) What would be the consequences of deficiency of haemoglobin in the human body ?

Q.8. Attempt any ONE of the following : **5**

- (1) Explain the structure and function of a nephron.
- (2) With the help of a diagram (Punnett square) show a Mendelian experiment where tall pea plant bearing red flowers is crossed with a short pea plant bearing white flowers. Write both the phenotypic and genotypic ratio for F_2 generation.

Best Of Luck 🍀

MT

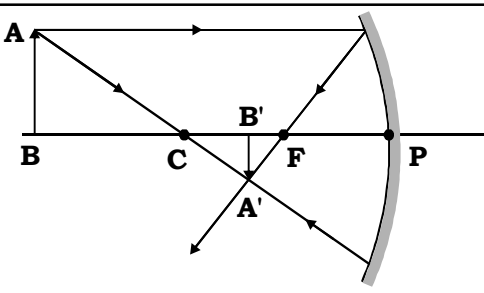
2014 ___ 1100

MT - SCIENCE & TECHNOLOGY (72) - PRELIM II - PAPER - 3

Time : 3 Hours

Prelim II Model Answer Paper

Max. Marks : 80

SECTION - A		
Q.1. (A) Answer the following sub-questions :		
(1) Colour blindness. It cannot be corrected, whereas the rest can be corrected.		1
(2) (i) The law used by Newlands to arrange elements is called Newlands Law of octaves.		1
(ii) Scientific evidence reveals that stratosphere ozone is being destroyed mainly by chlorine atoms of Chlorofluorocarbon (CFC) molecules.		1
(3) (i) False. A substance having pH value 7 will have no effect on litmus paper.		1
(ii) False. The unit of potential difference is volt.		1
Q.1. (B) Rewrite the following statements by selecting the correct options :		
(1) Which of the following represents the mirror formula ? $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$		1
(2) Which instrument is used to measure electric current ? Ammeter.		1
(3) What will be the equivalent resistance of two resistances of 5 and 10 ohms connected in parallel ? 10/3 ohms		1
(4) The pH range of human blood is 7.35 to 7.45.		1
(5) $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$ is a decomposition reaction.		1
Q.2. Attempt any FIVE of the following :		2
(1)	<div style="border: 1px solid black; padding: 10px;"><p>Image position : Between centre of curvature and focus.</p><p>Nature : Real, inverted and diminished.</p></div>	

(2)	Voltmeter	Ammeter	2
	1. It is an instrument to measure the potential difference between the two terminals of a cell. 2. It is connected in parallel with the cell. 3. It has a very high resistance.	1. It is an instrument to measure the electric current flowing through the circuit. 2. It is connected in series with the cell. 3. It has a very low resistance.	
(3)	1. The filament of a bulb has to get heated to a very high temperature to emit light. 2. If a filament of low melting point is used, it would melt and the bulb would become useless. 3. Hence a filament of high melting point is used so that the bulb can be used for a long time.		2
(4)	<p>Given : Image distance (v) = 5 cm Focal length (f) = 10 cm</p> <p>To find : Object distance (u) = ?</p> <p>Formula : $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$</p> <p>Solution : $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$</p> $\therefore \frac{1}{u} = \frac{1}{f} - \frac{1}{v}$ $\therefore \frac{1}{u} = \frac{1}{10} - \frac{1}{5}$ $\therefore \frac{1}{u} = \frac{1-2}{10}$ $\therefore \frac{1}{u} = \frac{-1}{10}$ $\therefore u = -10\text{cm.}$ <p>The object is placed in front of the convex mirror at a distance of 10 cm.</p>		2
(5)	Acid	Base	2
	1. Substances which are sour to taste have acidic ingredients and their solutions in water are called acids.	1. Substances which are bitter to taste have basic ingredients and their solutions in water are called bases.	

	<p>If 'i' is the angle of incidence and 'r' is angle of refraction then,</p> $\frac{\sin i}{\sin r} = \text{Constant.}$	
(4)	<p>Magnetic field : The area adjoining the magnet comprising of magnetic lines of force is called magnetic field.</p> <p>Characteristics of magnetic lines of force :</p> <ol style="list-style-type: none"> 1. Magnetic lines of force are closed continuous curves. They start from north pole and ends on south pole. 2. The tangent at any point on the magnetic lines of force gives the direction of the magnetic field at that point. 3. No two magnetic lines of force can intersect each other. 4. Magnetic lines of force are crowded where the magnetic field is strong and far from each other where the field is weak. 	3
(5)	<ol style="list-style-type: none"> 1. The symbols or molecular formulae of the reactants are written on the left hand side and products are on the right hand side. 2. Reactants and products are connected with an arrow (\rightarrow) pointing towards product side. 3. Whenever there are two or more reactants, a plus (+) sign is written between each of them. Similarly, if there are two or more products, a plus sign is written between them. 4. Certain reactions have to be carried out under specific condition such as temperature, pressure, catalyst. These condition are mentioned on the arrow pointing from reactants to product. 5. The physical states of reactants and products are also mentioned in a chemical equation to make it more informative. 6. The notations like g,l,s,aq are written in brackets as subscripts along with symbols/formulae of reactants and products. \uparrow or (g) - Gas (l) - Liquid (s) - Solid (aq) - Aqueous solution \downarrow - Precipitate. 	3
(6)	<ol style="list-style-type: none"> 1. He arranged chemically similar elements in the increasing order of their atomic masses in a group of three which is known as "Dobereiner's Triads". In a triad atomic mass of middle element 	3

is approximately equal to the mean of atomic masses of other two elements in that Triad.

Eg.: Lithium (Li), Sodium (Na), Potassium (K) form a triad as they show similar chemical properties. The atomic weights are 6.9, 23, 39 respectively.

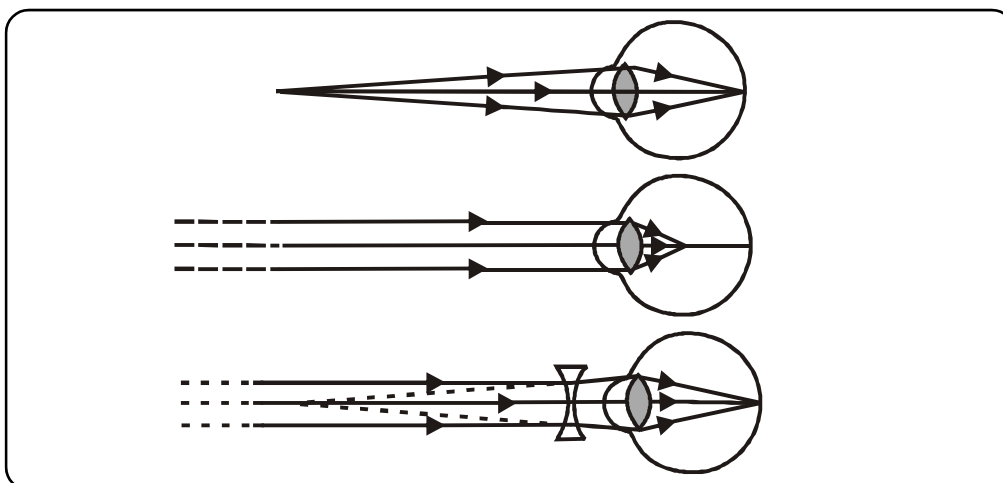
2. According to Dobereiner's law of triads,

$$\frac{6.9 + 39}{2} = \frac{45.9}{2} = 22.95 \sim 23 = \text{Atomic weight of sodium.}$$

Thus, the atomic weight of sodium (23) is the average of the atomic weights of lithium (7) and potassium (39).

Q.4. Attempt any ONE of the following :

- (1)
1. It is the defect in which a human eye can see nearby objects clearly but is unable to see distant objects clearly.
 2. In myopia, the image of distant object is formed in front of retina.
 3. There are two possible reasons of myopia :
 - (a) As ciliary muscles do not relax sufficiently, converging power of eye lens becomes high.
 - (b) The distance between eye lens and retina increases as the eyeball is lengthened or lens is curved.
 4. A concave lens of suitable focal length can correct this defect.
 5. The power of concave lens is so chosen that it creates required divergence and hence after the converging action of eye lens, the image is formed on the retina.

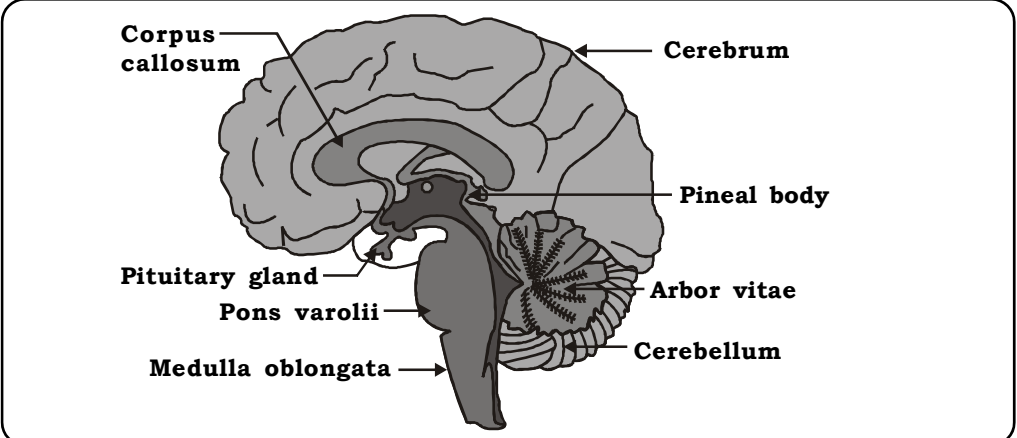


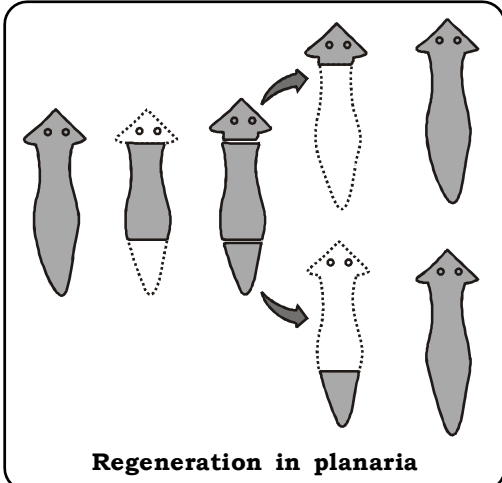
- (2)
1. An indicator is a dye that changes colour when it is put into acid or a base. An indicator gives different colours in acid and base. Thus an indicator tells us if the given substance is an acid or base by changing its colour. The three common indicators are : Litmus, methyl orange, phenolphthalein.

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	<p>Natural indicators : The most common indicators used for testing acids and bases in the laboratory is litmus that is a natural indicator. Litmus paper is obtained from a plant called as lichens (division thallophyta). Other examples are beetroot, turmeric, rose petals etc.</p> <p>Synthetic indicator : The indicator that is artificially prepared is called as synthetic indicator. Eg: Phenolphthalein, eosin, methyl orange are synthetic indicators.</p> <p>Universal indicator :</p> <ol style="list-style-type: none"> 1. It is a mixture of many different indicators (or dyes) which give different colours at different pH values. Just like litmus, universal indicator can be used in the form of solution or in the form of pH paper. 2. When an acid or base solution is added to the universal indicator, the indicator produces a new colour. The colour produced by universal indicator is used to find the pH value of acid or base by matching the colour with colours on pH colour chart which determines the strength of acid and bases. <p>Olfactory indicator : The term olfactory means relating to sense of smell. Those substances whose smell changes in acidic or basic solution are called as olfactory indicators. It works on the principle that when an acid or base is added to it, its characteristic smell cannot be detected. Onion and vanilla extract are olfactory indicators.</p> <p>Eg. : Onion has a characteristic smell. When a basic solution like sodium hydroxide solution is added to a cloth strip treated with onions, then the onion smell cannot be detected. An acidic solution like hydrochloric acid, does not destroy the smell of onions. This is used as a test for acids and bases.</p> <p style="text-align: center;">SECTION - B</p> <p>Q.5. (A) Answer the following sub-questions :</p> <ol style="list-style-type: none"> (1) $2\text{Al}_{(s)} + 3\text{H}_2\text{O}_{(g)} \rightarrow \text{Al}_2\text{O}_{3(s)} + 3\text{H}_{2(g)}$ 1 (2) (i) Pure gold is alloyed with silver or copper to make ornaments. 1 (ii) Electricity generated by renewable sources of energy is called bagasse. 1 (3) (i) A hydrocarbon in which the carbon atoms are linked to each other only by single covalent bond is called saturated hydrocarbons. 1 (ii) Eco-efficiency means the creation of goods and services using fewer resources and creating less waste. 1 	
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<p>Q.5.</p> <p>(1)</p> <p>(2)</p> <p>(3)</p> <p>(4)</p> <p>(5)</p>	<p>(B) Rewrite the following statements by selecting the correct options :</p> <p>C_nH_{2n} is the general formula of alkene.</p> <p>Diamond is the hardest substance and has the highest melting and boiling points.</p> <p>The process of absorption of water into raisins occurs through its membranes. This process is known as osmosis.</p> <p>To observe stomata in a dicot leaf, we must prepare a slide by taking the lower epidermis of the leaf.</p> <p>Oxygen is not essential for photosynthesis.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>				
<p>Q.6.</p> <p>(1)</p> <p>(2)</p>	<p>Attempt any FIVE of the following :</p> <ol style="list-style-type: none"> The undigested food and the residue of the digested food pass into the large intestine (about 1.5 m long). This part of the intestine does not have any digestive function as the digestion is already completed. The walls of the large intestine have villi which absorb most of the water and salts. The rest of the material is removed from the body through the anus. Here, the exit is regulated by the muscle called sphincter. 	<p>2</p> <p>2</p>				
<p>(2)</p>		<p>2</p>				
<p>(3)</p>	<table border="1"> <thead> <tr> <th data-bbox="295 1534 798 1579">Voluntary movements</th> <th data-bbox="805 1534 1316 1579">Involuntary movements</th> </tr> </thead> <tbody> <tr> <td data-bbox="295 1579 798 1904"> <ol style="list-style-type: none"> Movements which are under our control are called voluntary movements. Voluntary movements require thinking. Voluntary movements are controlled by cerebellum. Eg. Moving a table, kicking a ball, walking, clapping hands etc. </td> <td data-bbox="805 1579 1316 1904"> <ol style="list-style-type: none"> Movements which are not under our control are called involuntary movements. Involuntary movements do not require thinking. Involuntary movements are controlled by midbrain and hindbrain. Eg. Blood flow, breathing, sneezing etc. </td> </tr> </tbody> </table>	Voluntary movements	Involuntary movements	<ol style="list-style-type: none"> Movements which are under our control are called voluntary movements. Voluntary movements require thinking. Voluntary movements are controlled by cerebellum. Eg. Moving a table, kicking a ball, walking, clapping hands etc. 	<ol style="list-style-type: none"> Movements which are not under our control are called involuntary movements. Involuntary movements do not require thinking. Involuntary movements are controlled by midbrain and hindbrain. Eg. Blood flow, breathing, sneezing etc. 	<p>2</p>
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(4)	<ol style="list-style-type: none"> The capacity to regenerate is very high among some animals. They can reconstruct the entire body from the isolated body cells. Regeneration is carried out by specialised cells. These cells proliferate and make large number of cells which later develop into various cell types and help in production of new organisms. For example, when planaria is cut into many pieces, each piece develops into a whole planaria. This process occurs only if the planarial body gets cut into pieces. But animals cannot wait to be cut to reproduce. So regeneration is not the same as reproduction. 	 <p style="text-align: center;">Regeneration in planaria</p>	2				
(5)	<table border="1" style="width: 100%;"> <thead> <tr> <th style="text-align: center;">Diamond</th> <th style="text-align: center;">Graphite</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <ol style="list-style-type: none"> It is a hard, beautiful crystalline substance. Each carbon atom is linked to four other neighbouring carbon atoms. Shape is regular tetrahedron. No mobile electrons in the system and hence it is a non-conductor of electricity. </td> <td style="vertical-align: top;"> <ol style="list-style-type: none"> It is a soft, greyish black crystalline substance. Each carbon atom is attached to three other carbon atoms. Shape is hexagonal planar. Free electrons move throughout the layers and hence it is a good conductor of electricity. </td> </tr> </tbody> </table>	Diamond	Graphite	<ol style="list-style-type: none"> It is a hard, beautiful crystalline substance. Each carbon atom is linked to four other neighbouring carbon atoms. Shape is regular tetrahedron. No mobile electrons in the system and hence it is a non-conductor of electricity. 	<ol style="list-style-type: none"> It is a soft, greyish black crystalline substance. Each carbon atom is attached to three other carbon atoms. Shape is hexagonal planar. Free electrons move throughout the layers and hence it is a good conductor of electricity. 		2
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(6)	<ol style="list-style-type: none"> Calcium reacts with cold water to form calcium hydroxide and hydrogen gas. $\text{Ca}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow \text{Ca}(\text{OH})_{2(aq)} + \text{H}_{2(g)}$ <p style="text-align: center;">Calcium Water Calcium hydroxide Hydrogen</p> The heat produced is less which is not sufficient to burn the hydrogen gas. The piece of calcium metal starts floating in water as bubbles of hydrogen gas formed during the reaction stick to its surface. This reaction is less violent. 	2					
Q.7.	<p>Attempt any FIVE of the following :</p> <ol style="list-style-type: none"> The reduction of a metal oxide to form metal by using aluminium powder as a reducing agent is called as thermit reaction. 	3					

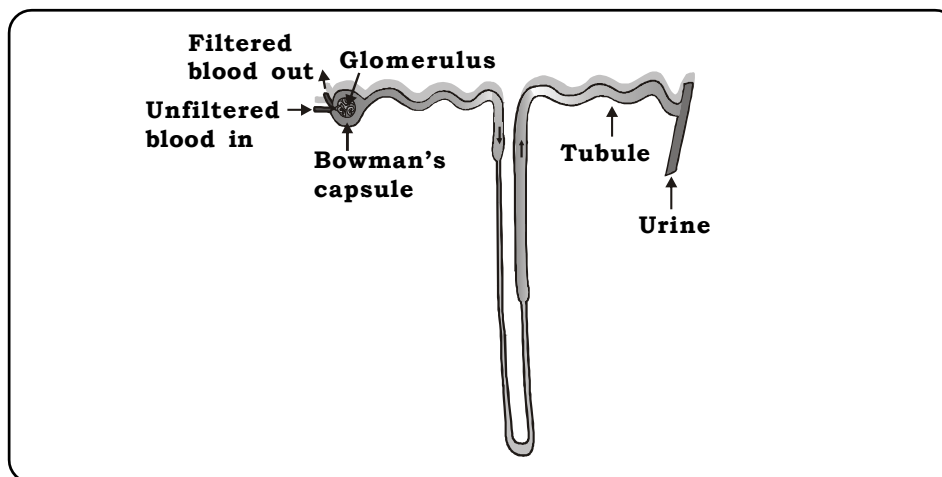
	<p>2. The reaction of metal oxide with aluminium powder is highly exothermic in which a large amount of heat is evolved.</p> <p>3. The heat liberated is so high that the metals are produced in molten state.</p> <p>Eg. :</p> $\text{Fe}_2\text{O}_{3(s)} + 2\text{Al}_{(s)} \rightarrow 2\text{Fe}_{(l)} + \text{Al}_2\text{O}_{3(s)} + \text{Heat}$ <p>Iron oxide Aluminium Molten iron Aluminium oxide</p> <p>(2) A group of organic compounds containing same functional group, which can be represented by the same general formula and which more or less shows similar trends in their properties is known as Homologous series. Some important characteristics of homologous series are -</p> <ol style="list-style-type: none"> 1. The general formula of all compounds in the series is the same. 2. They have the same functional group. 3. Physical properties like melting point, boiling point, density, generally show a gradual change with increase of molecular formula in the series. 4. On the other hand, chemical properties of the member shown close resemblance because of the presence of the same functional group in them. 5. Consecutive members of the series differ from one another by - CH₂- group which is known as the methylene group and their molecular weight differs by 14 units. <p>Example : The alkane family is a homologous series and characterized by the general formula : C_nH_{2n + 2}</p> <table border="1" data-bbox="331 1272 1220 1518"> <tbody> <tr> <td>Methane - CH₄</td> <td rowspan="2">- these differ by - CH₂ units.</td> </tr> <tr> <td>Ethane - C₂H₆</td> </tr> <tr> <td>Ethane - C₂H₆</td> <td rowspan="2">- these differ by - CH₂ units.</td> </tr> <tr> <td>Propane - C₃H₈</td> </tr> <tr> <td>Butane - C₄H₁₀</td> <td rowspan="2">- these differ by - CH₂ units.</td> </tr> <tr> <td>Pentane - C₅H₁₂</td> </tr> </tbody> </table>	Methane - CH ₄	- these differ by - CH ₂ units.	Ethane - C ₂ H ₆	Ethane - C ₂ H ₆	- these differ by - CH ₂ units.	Propane - C ₃ H ₈	Butane - C ₄ H ₁₀	- these differ by - CH ₂ units.	Pentane - C ₅ H ₁₂	3
Methane - CH ₄	- these differ by - CH ₂ units.										
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	<p>(3) The human nervous system can be divided into :</p> <ol style="list-style-type: none"> 1. The Central Nervous System (CNS) : It comprises of the brain and spinal cord and regulates all activities of the body. 2. The Peripheral Nervous System (PNS) : It includes all the nerves. The nerves form a network and spread throughout the body. They are instrumental in connecting all parts of the body to the central nervous system. 3. The Autonomic Nervous System (ANS) : It comprises of all the nerves present in the involuntary organs like heart, stomach, lungs etc. 	3									

	<p>4. On the basis of their function, the nerves are categorized as afferent and efferent nerves.</p> <p>5. The nerves are composed of neurons and neuroglia. The neurons are specialized cells capable of creating and transmitting electrochemical impulses. The neuroglia are supportive cells which assist the neurons in their function.</p> <p>(4) (i) Reduce, reuse and recycle is the three 'R mantra'. This is an effective way to eliminate waste and conserve resources.</p> <p>(iii) Reduce means using fewer resources in the first place.</p> <p>(iv) Reuse means instead of throwing things away, try to find ways to use them again.</p> <p>(v) Recycle means the items are put through a process that makes it possible to create new products out of the materials from the old ones.</p> <p>(vi) Reducing, reusing and recycling cut the amount of energy used to produce new items and amount of pollution generated as a result. It also conserves valuable natural resources that would otherwise be used to produce new items from raw materials.</p> <p>(5) (i) In Illinois, elm trees were sprayed with DDT.</p> <p>(ii) A large number of robins died near these trees due to DDT poisoning.</p> <p>(iii) The death of robins was due to the lethal dose of DDT that passed into their body from the earthworms which they consumed. Earthworms had concentrated DDT residue by feeding on fallen elm tree leaves.</p> <p>(iv) Due to biomagnification, the DDT concentration was enhanced through the food chain, which caused the death of many robins.</p> <p>(6) 1. Haemoglobin present in the RBCs of the blood carry oxygen to all the tissues of the body.</p> <p>2. If haemoglobin was absent in the human body and oxygen would have to move only by diffusion from lungs to toes, it would take three years for the oxygen to reach to the toes from the lungs.</p> <p>3. Deficiency of haemoglobin leads to a condition called anaemia in which the person experiences symptoms like headache, tiredness, weakness, breathlessness etc.</p>	<p>3</p> <p>3</p> <p>3</p>
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Q.8. Attempt any ONE of the following :

(1)

1. The basic filtration unit in the kidney is a cluster of thin walled blood capillaries called as a Nephron. Each kidney has approximately a million nephrons. Each nephron has a cup shaped thin walled upper end called Bowman's capsule which contains a bundle of blood capillaries called glomerulus.

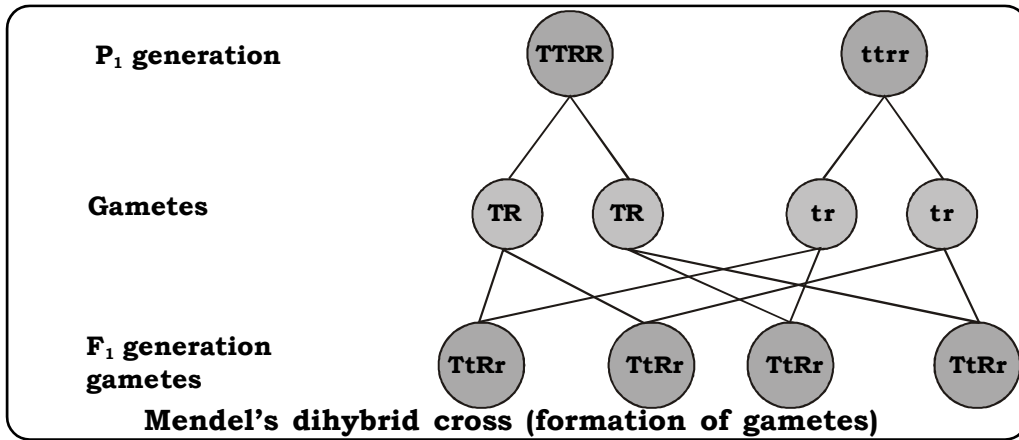
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2. Urea formed in the liver enters the blood. When blood containing urea enters the glomerulus, it gets filtered through glomerular capillaries.
3. The selectively permeable wall of the Bowman's capsule allows the water molecules and small molecules of other substances to pass through them and forms glomerular filtrate.
4. The glomerular filtrate collected in the Bowman's capsule further passes through the nephron tubule where reabsorption of water and useful molecules takes place.
5. The remaining fluid containing the waste, forms the urine which eventually enters long tube called the ureter. It is further stored in the urinary bladder and from there it is thrown out through the urethra.
6. As the bladder is muscular, it is under the control of nerves. As a result, we can usually control the urge to urinate.

(2)

1. Tallness is the dominant character and shortness is a recessive character of pea plant.
2. Similarly red colour of the flower is the dominant character and the white colour of the flower is the recessive character.
3. Therefore, the gene combinations for the characters will be TT (tallness), tt (shortness), RR (red flowers), rr (white flowers).

5



Cross between TtRr and TtRr :

♂ →		TR	Tr	tR	tr
♀ ⊕	TR	TTRR	TTRr	TtRR	TtRr
	Tr	TTRr	TTrr	TtRr	Ttrr
	tR	TtRR	TtRr	ttRR	ttRr
	tr	TtRr	Ttrr	ttRr	ttrr

The phenotype and genotype is shown in the table below :

Phenotype	No. of squares in chequer board	Genotype	No. of squares in chequer board
Tall with red flowers	9	TTRR	1
Short with red flowers	3	TTRr	2
Tall with white flowers	3	TtRR	2
Short with white flowers	1	TtRr	4
		TTrr	1
		ttRR	1
		ttRr	2
		Ttrr	2
		ttrr	1

The phenotypic ratio of F₂ generation is 9 : 3 : 3 : 1 and the genotypic ratio is 1 : 2 : 2 : 4 : 1 : 1 : 2 : 2 : 1.

