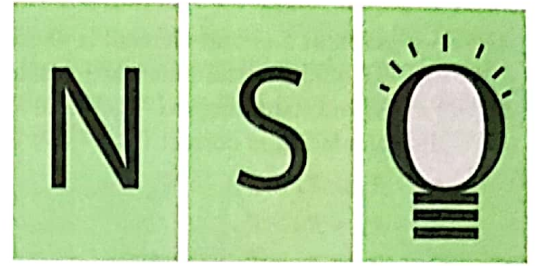


CLASS
10

LEVEL
2



**SOF NATIONAL SCIENCE
OLYMPIAD 2019-20**

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. In the school code column in the OMR Sheet, please fill in code allocated to your school and not the exam center code.
4. The Question Paper comprises two sections : **Science Section** (45 Questions) and **Achievers Section** (5 Questions).
Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
5. All questions are compulsory. There is no negative marking. Use of calculator / smart phone is not permitted.
6. There is only ONE correct answer. Choose only ONE option for an answer.
7. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.
Q.16: In the water cycle, condensation is the process of
A. Water vapour cooling down and turning into a liquid
B. Ice warming up and turning into a liquid
C. Liquid cooling down and turning into ice
D. Liquid warming up and turning into water vapour
As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.

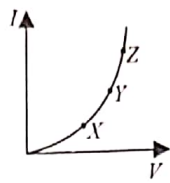
16.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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8. Rough work should be done in the blank space provided in this booklet.
9. Please fill in your personal details in the space provided on this page before attempting the paper.
10. **RETURN THE OMR SHEET AND QUESTION PAPER TO THE INVIGILATOR AT THE END OF THE EXAM.**



Name:.....

Section:..... SOF Olympiad Roll No.:..... Contact No.:.....

1. I - V graph of a circuit element is shown in the given figure. A student determines the resistance at points X , Y and Z and states them as R_X , R_Y and R_Z respectively. His calculation is correct if



- A. $R_X > R_Y > R_Z$
 B. $R_X < R_Y > R_Z$
 C. $R_X < R_Y < R_Z$
 D. $R_X = R_Y = R_Z$

2. Read the given statements and select the correct option.

Statement 1: A current carrying square loop placed in a uniform magnetic field experiences no net force.

Statement 2: The net charge on a current carrying loop is zero.

- A. Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
 B. Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
 C. Statement 1 is true but statement 2 is false.
 D. Statement 1 is false but statement 2 is true.

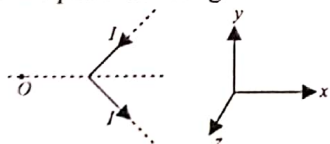
3. Which of the following statements is incorrect?

- A. In a primary rainbow, red colour is formed on the top and violet colour on the bottom.
 B. A normal human eye cannot clearly see all the objects at the different distances.
 C. A beam of white light gives a spectrum on passing through a hollow prism.
 D. Aqueous humor maintains the shape of the front part of the eye.

4. Image of an object approaching a convex mirror with radius of curvature of 30 m along its optical axis is observed to move from $\frac{50}{7}$ m to $\frac{35}{6}$ m in 50 s. What is the average speed of the object?

- A. 23.18 cm s⁻¹ B. 2.62 cm s⁻¹
 C. 8.18 cm s⁻¹ D. 4.09 cm s⁻¹

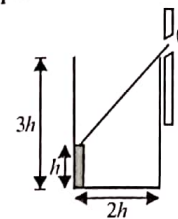
5. The given figure shows a V-shaped wire lying in x - y plane. A current of I ampere flows in the wire. The direction of the magnetic field at point O which lies in the same plane is along



- A. Positive z -axis B. Positive x -axis
 C. Negative z -axis D. Negative x -axis.

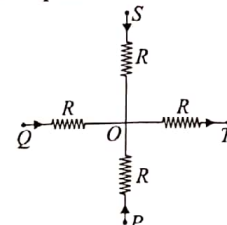
6. An observer can see through a pinhole, the top end of a thin rod of height h , placed as shown in the figure. The beaker height is $3h$ and its radius is h . When the

beaker is filled with a liquid up to a height $2h$, he can see the lower end of the rod. Then the refractive index of the liquid is



- A. $\frac{5}{2}$ B. $\sqrt{\frac{5}{2}}$
 C. $\sqrt{\frac{3}{2}}$ D. $\frac{3}{2}$

7. A part of a circuit is shown in the figure and the points P , Q and S are at same potential. If the potential difference between the points Q and T is 30 V, then the potential difference between points P and O is

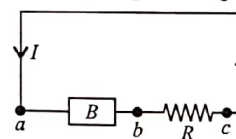


- A. 7.5 V B. 10 V
 C. 15 V D. 5 V

8. Bulb X (200 W-250 V) and bulb Y (100 W-200 V) are connected in series across 250 V. What is potential drop across bulb Y ?

- A. 200 V B. 250 V
 C. 140 V D. 48 V

9. The given figure shows current I is flowing in the circuit. Circuit has a battery B , a resistor R and connecting wires of small resistance. If the electric potentials at points a , b and c are V_a , V_b and V_c respectively, then

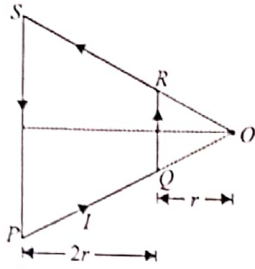


- A. $V_a > V_b > V_c$ B. $V_b > V_a = V_c$
 C. $V_c > V_a = V_b$ D. $V_b > V_c > V_a$

10. A stream of electrons is projected horizontally to the left. A straight current carrying conductor is supported parallel to the electron stream and above it. If the current in the conductor is flowing from left to right then, what will be the effect on the electron stream?

- A. The stream of electrons will be pulled upwards.
 B. The stream of electrons will be pushed downwards.
 C. The stream of electrons will be retarded.
 D. The stream of electrons will speed up towards the right.

11. Consider a closed loop in the form of a trapezium $PQRS$, carrying current I .



Match column I with column II regarding the magnitude of magnetic field at point O and select the correct option from the given codes.

Column I

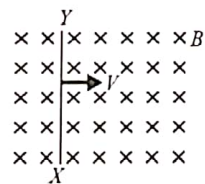
Column II

- | | |
|--|------------------------------------|
| (a) Magnetic field due to PQ is | (i) Greater than that due to SP |
| (b) Magnetic field due to QR is | (ii) Greater than that due to RS |
| (c) Magnetic field due to SP is | (iii) Not equal to zero |
| (d) Total magnetic field due to PQ and RS is | (iv) Zero |
- A. (a)-(ii), (iii); (b)-(i), (iii); (c)-(i); (d)-(iii)
 B. (a)-(i), (ii), (iii); (b)-(i), (iv); (c)-(ii); (d)-(ii)
 C. (a)-(iv); (b)-(i), (ii), (iii); (c)-(ii), (iii); (d)-(iv)
 D. (a)-(iv); (b)-(iii); (c)-(i), (ii); (d)-(ii), (iii)

12. A person can see objects clearly only when they lie between 50 cm and 500 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, the type and power of the correcting lens the person has to use, will be

- A. Convex, +2.25 dioptre
 B. Concave, -0.25 dioptre
 C. Concave, -0.2 dioptre
 D. Convex, +0.15 dioptre.

13. A small conducting rod of length l , moves with a uniform velocity V in a uniform magnetic field B as shown in figure. Then

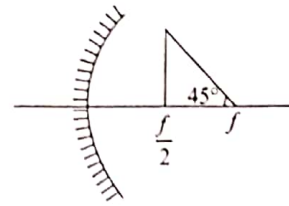


- A. The end X of the rod becomes positively charged.
 B. The end Y of the rod becomes positively charged.
 C. The entire rod is unerringly charged.
 D. The rod becomes hot due to joule heating.

14. Which of the following statements is/are incorrect?

- I. Asphalt which is obtained in the fractional distillation of crude oil, is not used as fuel.
 II. Liquefied petroleum gas has a lower calorific value than methane.
 III. Natural gas is lighter than air.
 IV. When coal is heated strongly in the presence of air, it changes into coke.
- A. I only
 B. IV only
 C. I, II and III only
 D. II and IV only

15. A wire is bent in the shape of a right angled triangle and is placed in front of a concave mirror of focal length f , as shown in the figure. Which of the figures shown in the four options qualitatively represents the shape of the image of the bent wire? (These figures are not to scale.)

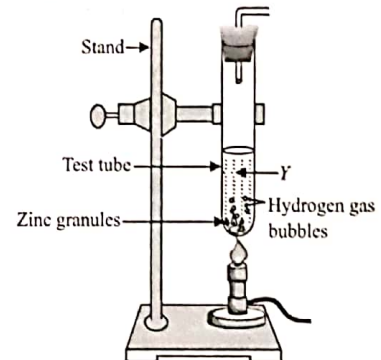


- A. $\alpha > 45^\circ$
- B.
- C. $0 < \alpha < 45^\circ$ α
- D.

16. An ester of molecular formula, $C_4H_8O_2$ was produced by the reaction of an alcohol 'X' with a carboxylic acid 'Y'. X and Y could be respectively

- A. Methanol and propanoic acid
 B. Ethanol and ethanoic acid
 C. Propanol and methanoic acid
 D. All of these.

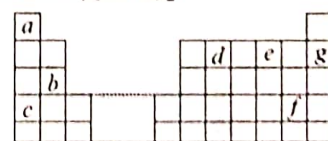
17. Observe the given experimental set-up carefully.



Solution Y and the final product formed in the experiment could be respectively

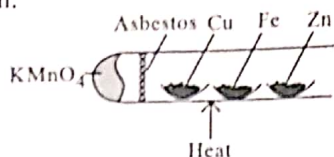
- A. $NaOH$ and Na_2ZnO_2
 B. $NaCl$ and Na_2ZnO_2
 C. Dilute HCl and $ZnCl_2$
 D. Both A and C.

18. The diagram shows a part of the periodic table with few elements. Identify the set of two elements which combine together to form a covalent compound with a formula of the type PQ_2 .



- A. b and c
 B. d and e
 C. g and f
 D. a and f

19. Ms Ranjana, a science teacher performed an experiment to demonstrate the reactions of metals Cu, Fe and Zn with oxygen.

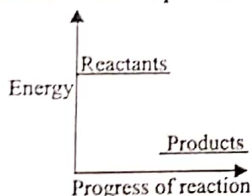


- She first heated the metals to red hot and then heated KMnO_4 which decomposes to liberate oxygen gas. Which of the following represents the correct observation?
- Fe forms a reddish-brown residue.
 - Cu forms a black residue.
 - Zn forms a residue which is yellow when hot and white when cold.
 - All of these

20. When a small amount of light green coloured compound 'P' is heated in a test tube, it loses some water in the beginning and then gas(es) 'R' with suffocating smell come(s) out and a reddish brown residue 'Q' is left behind in the test tube. The vapours of gas(es) 'R' when collected and dissolved in water form a solution which turns blue litmus red. Identify P, Q and R.

P	Q	R
A. CaSO_4	CaO	SO_2
B. $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	Fe_2O_3	SO_2, SO_3
C. $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$	$\text{Na}_2\text{SO}_4 \cdot \text{H}_2\text{O}$	SO_3
D. $\text{FeSO}_4 \cdot \text{H}_2\text{O}$	Fe_2O_3	O_2

21. The given diagram shows the energy levels of the reactants and products for a particular reaction.

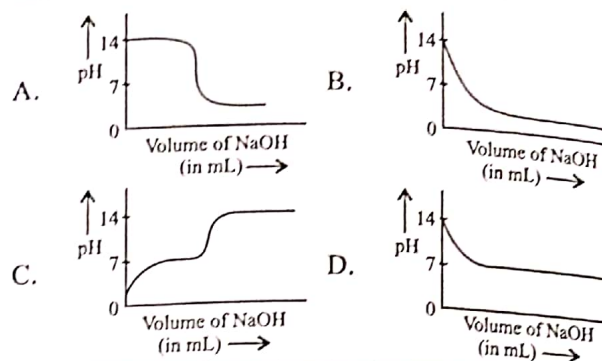


Which of the following processes can be related to the given diagram?

- Combustion of ethyne gas
 - Thermite reaction
 - Neutralisation reaction
 - All of these
22. Identify W, X, Y and Z from the given information.
- W : A metal that forms two types of oxides.
 X : A metal which displaces hydrogen from dilute nitric acid.
 Y : A metal that does not react with water and steam.
 Z : A metal which is a poor conductor of heat.

W	X	Y	Z
A. Fe	Mg	Al	Hg
B. Zn	Pb	Cu	Ag
C. Al	Mg	Pb	Hg
D. Fe	Mn	Cu	Pb

23. Which of the following graphs roughly shows the change in pH when sodium hydroxide solution is added to ethanoic acid until it is in excess?

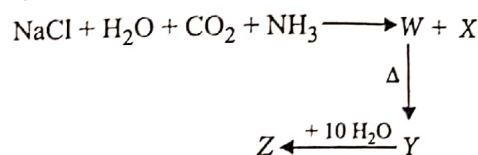


24. Which of the following hydrocarbons will undergo addition reactions?

- (i) C_2H_6 (ii) C_4H_6 (iii) C_3H_6
 (iv) CH_4 (v) C_4H_{10} (vi) C_3H_4

- (i) and (iv) only
- (ii), (iii) and (vi) only
- (i), (iv) and (v) only
- (iii) and (v) only

25. Study the given series of reactions carefully.



W and Z are respectively

- Milk of magnesia and vinegar
- Milk of magnesia and lime
- Baking soda and washing soda
- Slaked lime and washing soda.

26. pH of different solutions are given in the table.

Solution	pH
W	2.4
X	13.8
Y	7.5
Z	9.0

Arrange these solutions in the decreasing order of H^+ ion concentration.

- $X > Z > Y > W$
- $W > Y > Z > X$
- $Y > Z > X > W$
- $X > Z > W > Y$

27. Which of the following statements is incorrect?
- If a solution is acidic, then the concentration of OH^- ions is greater than the concentration of H^+ ions in the solution.
 - Aqueous solution of KNO_3 is almost neutral.
 - When CuSO_4 is dissolved in water, it gives a solution having $\text{pH} < 7$.
 - Aqueous solution of Na_2CO_3 is basic in nature.

28. Following elements are present in the second period of the periodic table from left to right.

Li, Be, B, C, N, O, F, Ne

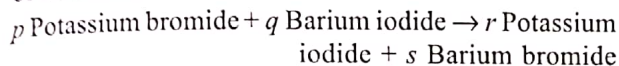
Few statements are given about these elements :

- (i) O and F exist as monoatomic gases.
- (ii) Li is the lightest element in the period.
- (iii) B is a metalloid while C is a metal.
- (iv) Li and F react to form a compound LiF.

The correct statements are

- A. (i) and (iii) only B. (ii) and (iv) only
C. (ii) and (iii) only D. (i) and (iv) only.

29. Balance the given reaction and find the values of p , q , r and s respectively and also, identify the type of reaction.



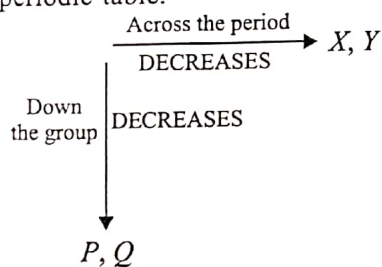
- A. 1, 1, 1, 1; Double displacement reaction
B. 1, 1, 1, 1; Decomposition reaction
C. 2, 1, 2, 1; Double displacement reaction
D. 2, 1, 2, 1; Decomposition reaction

30. Which of the following statements is/are correct?

- I. On exposure to air, Glauber's salt gains weight while quick lime loses weight.
- II. When bleaching powder reacts with hydrochloric acid, two gases CO_2 and Cl_2 are produced.
- III. Nettle-leaf-hair sting injects methanoic acid into the skin of a person.
- IV. 'Chloride of lime' is prepared by passing chlorine gas through quick lime directly.

- A. III only B. I, II and IV only
C. II and IV only D. I, II and III only

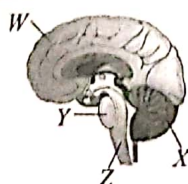
31. Observe the following trends in the periodic properties, in the periodic table.



Identify the properties X , Y , P and Q respectively.

- A. Effective nuclear charge, non-metallic character, atomic size and metallic character
B. Metallic character, atomic size, electronegativity and non-metallic character
C. Atomic size, metallic character, valency and non-metallic character
D. Valency, non-metallic character, electronegativity and effective nuclear charge

32. Refer to the given figure and select the correct statement regarding the labelled parts.



- A. Association area of Z interprets sensory information.

- B. X controls thirst, temperature and water balance in body.
C. Y mainly consists of nerve fibres and takes part in regulating respiration.
D. W controls involuntary functions of visceral organs, breathing and sneezing.

33. Refer to the given figure 1 (pre-fertilised flower) and figure 2 (human female reproductive system) and select the incorrect statement regarding the labelled parts.

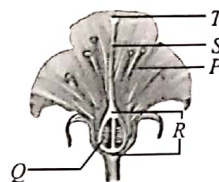


Figure 1

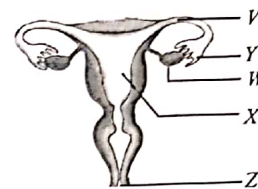


Figure 2

- A. The parts labelled as T and Z are functional equivalents.
B. The parts labelled as W and Q produce female gametes.
C. The function of part V is same as part P while that of part Y is same as part S .
D. Development of respective embryos occur inside parts Q and X .

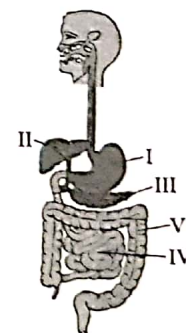
34. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
(a) <i>Rhizopus</i>	(i) Binary fission
(b) <i>Planaria</i>	(ii) Budding
(c) <i>Leishmania</i>	(iii) Spore formation
(d) Yeast	(iv) Regeneration

A. (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)
B. (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)
C. (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)
D. (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

35. Read the following statements with respect to the given diagram.

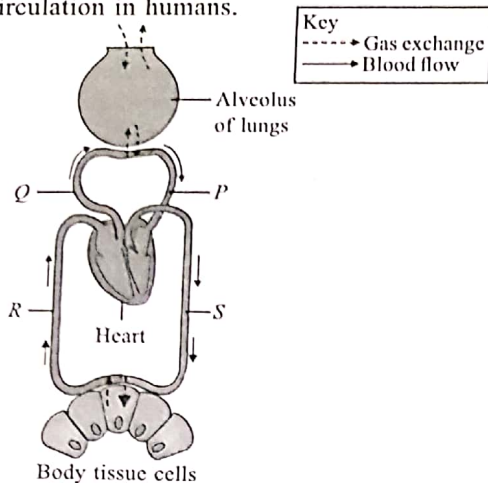
- (i) A major amount of carbohydrates are digested in I.
- (ii) Chief fat digesting enzyme is present in III.
- (iii) Digestion of proteins starts in V.
- (iv) Enzymes sucrase and lactase are secreted by IV.
- (v) II stores bile which emulsifies fat.



Which of the above statements are correct?

- A. (i), (ii) and (iv) only
B. (ii) and (iv) only
C. (iii), (iv) and (v) only
D. (ii), (iv) and (v) only

36. Refer to the given diagrammatic representation of double circulation in humans.



Select the incorrect statements regarding *P*, *Q*, *R* and *S*.

- (i) Parts labelled as *P* and *S* carry blood with low oxygen concentration.
 (ii) Parts labelled as *Q* and *R* carry blood with high oxygen concentration.
 (iii) When ventricles contract, *S* carries oxygen rich blood to tissues and *Q* carries carbon dioxide rich blood to lungs.
- A. (i) and (ii) only B. (ii) and (iii) only
 C. (i) and (iii) only D. (i), (ii) and (iii)

37. Which of the following statements regarding natural selection is correct?

- A. Individuals which inherit traits that enable them to survive better, enjoy a competitive advantage over others.
 B. Both useful and non-useful variations are inherited to the next generation.
 C. Climate also plays a role in shaping natural selection among plants and animals in the wild.
 D. Both A and C

38. Select the incorrect statement.

- A. If frog is eaten by a snake then the energy will be transferred from tertiary consumer to secondary consumer.
 B. Silviculture is the practice of controlling the growth, composition and quality of forests to meet diverse needs and values.
 C. *Khadins* are traditional rainwater harvesting system for agriculture in Rajasthan.
 D. Construction of high rise dams causes several environmental problems such as deforestation, loss of biodiversity, etc.

39. Read the following statements.

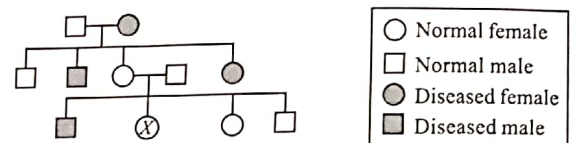
- I. In a food chain, there is a cyclic flow of energy from the Sun to consumers, producers, and then to decomposers which transfer it back to consumers by decomposition.

- II. Longer food chains provide more energy to the top consumer as compared to shorter food chains.
 III. In an ecosystem, food chains become interconnected at various trophic levels to form a complex web called food web.
 IV. If 100 joules of energy is available at the producer level, then amount of energy present at the level of primary consumers is about 10 joules.

Which of these statements are incorrect?

- A. I and II only B. II and III only
 C. III and IV only D. I and IV only

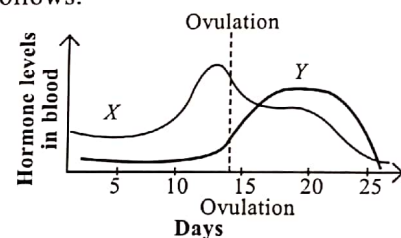
40. Galactosaemia is a condition caused by a recessive allele of an autosomal gene in which galactose cannot be metabolised. The given pedigree shows the pattern of inheritance of galactosaemia in a family.



What is the chance that individual *X* is a carrier of this condition?

- A. 1/2 B. 1/3
 C. 2/3 D. 1/4

41. The given graph shows changes in hormonal level of two hormones *X* and *Y* during a normal menstrual cycle. Identify the hormones and answer the question that follows.



If hormone *Y* is lacking in an adult female then

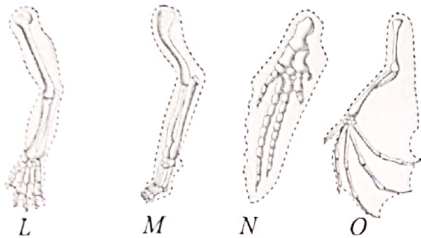
- A. The uterine lining might not be sufficiently stable for implantation of fertilised ovum
 B. Production of sperms will be affected
 C. Absorption of calcium from the bowel and the conversion of glycogen to glucose will not occur
 D. None of these.

42. Which of the following activities will help to sustain environmental balance?

- (i) Usage of platinum jewellery as it will reduce the load on gold mines.
 (ii) Farming as it helps to ensure that man does not eat up all the food producers.
 (iii) Use of jute bags instead of polybags.
 (iv) Using solar energy as it provides an alternative to fossil fuels.
- A. (ii), (iii) and (iv) only
 B. (i), (ii) and (iv) only
 C. (ii) and (iv) only
 D. (iii) only

43. Select the incorrect statement regarding IUDs.
- Intra-uterine Devices (IUDs) are the plastic or metal objects which are inserted in the uterus of the female through vagina by expert doctors.
 - IUDs may be categorised as non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (e.g., CuT, Cu7) and hormone releasing IUDs (e.g., progestasert).
 - Usage of IUDs is an irreversible method of contraception.
 - All of these

44. The given figures represent structure of forelimbs of different organisms which are labelled as L, M, N and O.



Which of the following statements is incorrect regarding these figures?

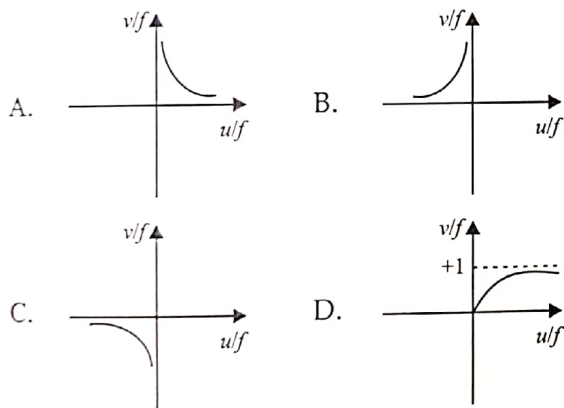
- Both M and N are adapted for the same function thus they are analogous organs.
 - L and O both have same basic structural plan, thus they are homologous organs.
 - N and O are adapted for different functions, i.e., swimming and flying respectively thus, they are analogous organs.
 - Both A and C.
45. Read the given paragraph and select the option that correctly fills the blank.

The morphology of genitalia (of male and female) of two populations is very complicated and unlike. They cannot interbreed due to _____.

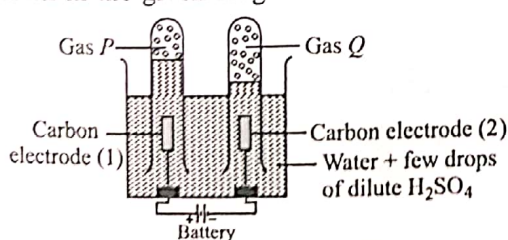
- Temporal isolation
- Psychological isolation
- Gametic isolation
- Mechanical isolation

ACHIEVERS SECTION

46. Which of the following graphs represents u/f versus v/f graph for a virtual erect image by a diverging lens? (u = object distance, v = image distance, f = focal length)



47. An electric current was passed through acidulated water as shown in the given diagram :



Which of the following statements is/are correct?

- A few drops of H_2SO_4 are added to water to increase its conductivity.
- Carbon electrode (1) is the anode and carbon electrode (2) is the cathode.

III. This is an example of electrolytic decomposition reaction.

IV. Oxidation takes place at electrode (1) and reduction takes place at electrode (2).

- II and IV only
- I only
- I and III only
- I, II, III and IV

48. Study the given section of the periodic table.

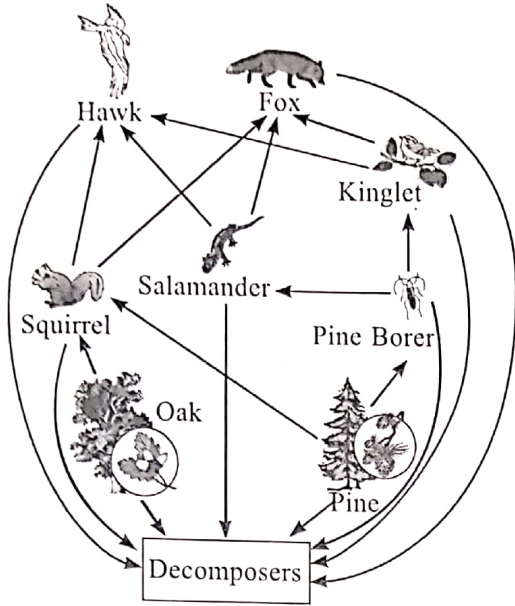
Group \ Period	1	2	13	14	15	16	17	18
1	P							
2		Q	T		U	V	W	X
3	R	S		Y			Z	

Now, read the given passage and fill in the blanks by selecting an appropriate option.

Elements (i) are metalloids while element (ii) is a non-metal with high electronegativity. Element Y forms a very common dioxide which exists in (iii) state. Among the second period elements, element (iv) has the smallest atomic size.

- | | (i) | (ii) | (iii) | (iv) |
|----|------|------|---------|------|
| A. | U, V | W | Gaseous | Q |
| B. | T, Y | W | Solid | W |
| C. | T, U | X | Liquid | X |
| D. | T, Y | Z | Solid | U |

49. Refer to the given food web and select the incorrect statement.



A. There is only one organism that synthesises organic compounds from inorganic substances.

- B. There is no such organism that converts organic compounds into inorganic substances.
- C. Removal of fox from the food web will cause an increase in the population of kinglet.
- D. Both A and B

50. Refer to the given dichotomous key and select the correct option regarding it.

- I. (a) It involves single parent. - Go to II
(b) It involves both male and female parents.- *W*
- II. (a) Production of new individual from an outgrowth formed on the parent body .- *X*
(b) Production of new individual from the parts of plant other than seeds. - Go to III
- III. (a) The propagule is a stem. - *Y*
(b) The propagule is a root. - *Z*

	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>
A.	<i>Vinca</i>	<i>Scypha</i>	Guava	Ginger
B.	Papaya	<i>Hydra</i>	Ginger	Sweet potato
C.	<i>Ceratophyllum</i>	<i>Mucor</i>	Onion	Banana
D.	<i>Mirabilis</i>	<i>Spirogyra</i>	<i>Colocasia</i>	Sweet potato

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