



Inspiring Young Minds
Through Knowledge Olympiads

CLASS
10

QUESTION PAPER SET

C



DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Name:

SOF Olympiad Roll No.:

Contact No.:

Total Questions: 50

Time: 1 hr.



SOF NATIONAL SCIENCE
OLYMPIAD 2022-23

Guidelines for the Candidate

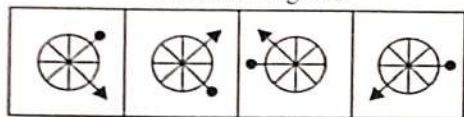
1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Roll No. and Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises three sections:
Logical Reasoning (10 Questions), **Science** (35 Questions) and **Achievers Section** (5 Questions)
Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only **ONE** correct answer. Choose only **ONE** option for an answer.
6. 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.
7. Rough work should be done in the blank space provided in the booklet.
8. Return the OMR Sheet to the Invigilator at the end of the exam.
9. Please fill in your personal details in the space provided on this page before attempting the paper.

16. ● (B) (C) (D)

LOGICAL REASONING

1. Which of the following figures will continue the same series as established by the Problem Figures?

Problem Figures



- A. B. C. D.

2. If 'A' means '×', 'B' means '-', 'C' means '÷' and 'D' means '+', then what will be the value of the given expression?

$$(48 \text{ C } 6) \text{ B } (32 \text{ C } 4) \text{ D } (3 \text{ A } 4)$$

- A. 7 B. 34
C. 12 D. 28

3. Select the correct water image of given combination of letters and symbols.

O@LYM@P#IC

- A. O@LYM@P#IC B. I#P@MYJ@O
C. I#P@MYJ@O D. O@LYM@P#IC

4. In a row of children facing North, Neeta is fifteenth from the left end of the row. If she is shifted towards the right end of the row by four places, she becomes eighth from the right end. How many children are there in the row?

- A. 27 B. 26
C. 25 D. None of these

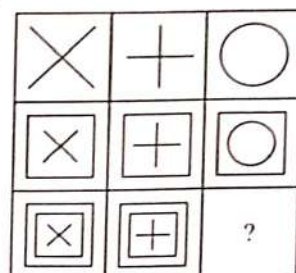
5. Pointing towards a woman, Kartik said, "She is the only daughter of my wife's grandfather's only child." How is the woman related to Kartik?

- A. Sister B. Wife
C. Cousin D. Daughter

6. Sanjeev walks 10 m towards the South. Turning to the left, he walks 20 m and then moves to his right. After moving a distance of 20 m, he turns to the right and walks 20 m. Finally, he turns to the right and moves a distance of 10 m. How far and in which direction is he now from the starting point?

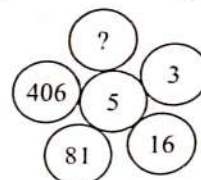
- A. 10 m, North B. 20 m, South
C. 20 m, North D. 10 m, South

7. Select a figure from the options which will complete the given figure matrix.



- A. B. C. D.

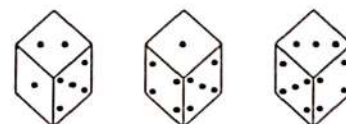
8. Find the missing number in the given figure pattern.



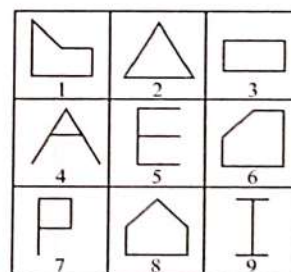
- A. 1631 B. 531
C. 1625 D. 2031

9. Three positions of a dice are shown below. Find the number of dots on the face opposite to the face having four dots.

- A. 3
B. 1
C. 2
D. 5



10. Group the given figures into three classes on the basis of their identical properties using each figure only once.



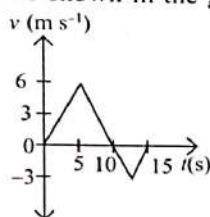
- A. 1, 3, 4; 2, 7, 8; 5, 6, 9
B. 1, 6, 8; 2, 4, 9; 3, 5, 7
C. 1, 3, 7; 2, 6, 8; 4, 5, 9
D. 1, 3, 6; 2, 4, 8; 5, 7, 9

SCIENCE

11. A convex lens of focal length f is placed somewhere in between an object and a screen. The distance between object and screen is L . If numerical value of magnification produced by the lens is m , focal length of the lens is

- A. $\frac{mL}{(m-1)^2}$ B. $\frac{(m-1)^2}{m}L$
 C. $\frac{mL}{(m+1)^2}$ D. $\frac{(m+1)^2}{m}L$

12. The speed-time graph of a particle moving along a fixed direction is as shown in the given figure.



- I. The distance traversed by the particle between $t = 0$ s to $t = 10$ s is 30 m.
 II. The distance traversed by the particle between $t = 10$ s to $t = 15$ s is 9.5 m.
 III. The distance traversed by the particle between $t = 10$ s to $t = 15$ s is 7.5 m.
 IV. The distance traversed by the particle between $t = 0$ s to $t = 15$ s is 37.5 m.

Select the correct option from the given statements.

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

13. A uniform chain of length L and mass M is lying on a smooth horizontal table and one third of its length is hanging vertically down over the edge of the table. If g is acceleration due to gravity, work required to pull the hanging part onto the table is

- A. MgL B. $\frac{MgL}{3}$
 C. $\frac{MgL}{9}$ D. $\frac{MgL}{18}$

14. Which of the following statements is true about a long solenoid carrying current?

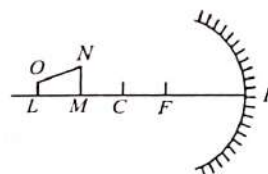
- (i) The field lines inside the solenoid are in the form of straight lines which indicate that the magnetic field is same at all points inside the solenoid.
 (ii) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.

- (iii) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.

- (iv) The N-and S-poles exchange positions when the direction of current through the solenoid is reversed.

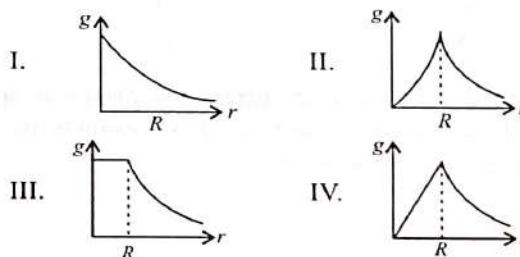
- A. (i) only
 B. (ii) only
 C. (i), (ii) and (iv) only
 D. (iii) only

15. An object $LMNO$ is placed in front of a concave mirror beyond the centre of curvature C as shown in the given figure. Which of the following options is correct regarding the magnitude of magnifications of images of LO and MN ?



- A. $|m_{LO}| < 1$ and $|m_{MN}| < 1$
 B. $|m_{LO}| < |m_{MN}|$
 C. $|m_{LO}| > |m_{MN}|$
 D. Both A and B

16. The dependence of acceleration due to gravity g on the distance r from the centre of the Earth, assumed to be a sphere of radius R of uniform density, is shown in the given figures.



The correct figure is

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

17. Two beams of red and violet colour are made to pass separately through a prism (angle of prism is 60°). In the position of minimum deviation, the angle of refraction will be

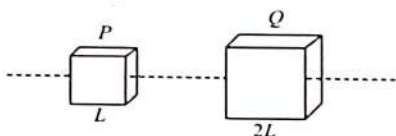
- A. 30° for both the colours
 B. Greater for the red colour
 C. Greater for the violet colour
 D. 60° for both the colours.

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

Statement 1 : The loudness or softness of sound is determined basically by its amplitude.

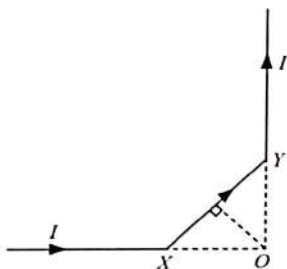
Statement 2 : Higher the frequency of sound, lower is its pitch.

- 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. Both statements 1 and 2 are false.
19. There are two square plates P and Q of same material. The thickness of Q is twice that of P and these plates are connected in series as shown in the given figure. If the resistance of P and Q are denoted by R_P and R_Q , then $R_P : R_Q$ is



- A. 2 : 1
 B. 4 : 1
 C. 1 : 2
 D. 1 : 1
20. A uniform wire of resistance R is cut into ten parts of equal length. Two parts each are joined in series and then five such combinations are joined in parallel. Now, the equivalent resistance is
- A. $\frac{R}{2}$
 B. $\frac{R}{4}$
 C. $\frac{R}{15}$
 D. $\frac{R}{25}$

21. A long wire, carrying current I is placed as shown in the given figure. Section XY is a straight line. The net magnetic field at O is



- A. Perpendicular to the plane of the paper and directed into the paper
 B. At an angle $\pi/4$ to the plane of the paper
 C. Along the bisector of the angle XOY away from XY
 D. Along the bisector of XOY towards XY .

22. During a football match, the ball shot towards the goal struck the defender's foot at the speed of 10 m s^{-1} and it is bounced back by the goalkeeper at 10 m s^{-1} . If the time of impact was 0.2 s and mass of the ball is $1/2 \text{ kg}$, then average force exerted by defender on the ball is

- A. 75 N
 B. 35 N
 C. 50 N
 D. 0 N

23. Two compounds X and Y have the same molecular formula, $\text{C}_3\text{H}_6\text{O}_2$. Identify the functional groups and structural formulae of X and Y .

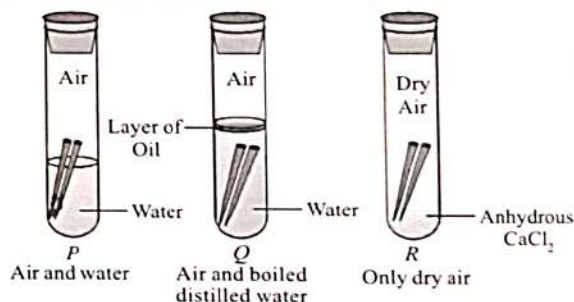
- A. $-\text{COOH}$ and $-\text{COOR}$, $X = \text{CH}_3\text{CH}_2\text{COOH}$,
 $Y = \text{CH}_3\text{COOCH}_3$
 B. $-\text{CHO}$ and $-\text{CO}$, $X = \text{CH}_3\text{CH}_2\text{CHO}$,
 $Y = \text{CH}_3\text{COCH}_3$
 C. $-\text{CO}$ and $-\text{COOH}$, $X = \text{CH}_3\text{COCH}_3$,
 $Y = \text{CH}_3\text{CH}_2\text{COOH}$
 D. $-\text{CHO}$ and $-\text{COOH}$, $X = \text{CH}_3\text{CH}_2\text{CHO}$,
 $Y = \text{CH}_3\text{CH}_2\text{COOH}$

24. Read the given passage and fill in the blanks by selecting an appropriate option.

(i) is a pure substance that cannot be broken down to simpler substances. (ii) are pure substances that can be broken down into simpler substances by chemical or electrochemical methods. Water and alcohol form a (iii) mixture that has (iv) composition.

- | | (i) | (ii) | (iii) | (iv) |
|----|----------|-----------|---------------|-------------|
| A. | Compound | Elements | Heterogeneous | Uniform |
| B. | Element | Compounds | Homogeneous | Uniform |
| C. | Element | Mixtures | Heterogeneous | Non-Uniform |
| D. | Compound | Elements | Homogeneous | Non-Uniform |

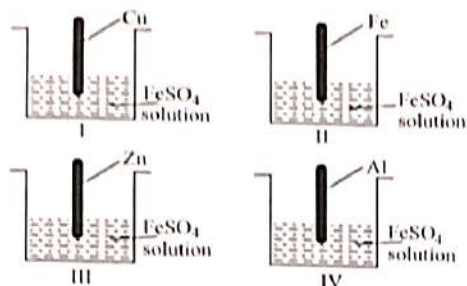
25. Raghav set up the following apparatus to investigate the conditions under which iron rusts.



Now, select the correct statement(s) regarding the given experimental set up.

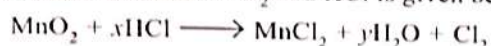
- I. Rusting will take place in all the test tubes.
 II. Rusting will occur in test tubes P and Q and not in test tube R .
 III. Rusting will not occur in test tubes Q and R .
- A. I and III only
 B. II and III only
 C. III only
 D. I and II only

26. In which of the following beakers reaction will take place?



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

27. The reaction between MnO_2 and HCl is given below:



Balance the above equation and select the correct option.

	x	y	Oxidising agent	Reducing agent
A.	2	1	Cl_2	MnO_2
B.	4	2	MnO_2	HCl
C.	2	4	HCl	MnO_2
D.	2	2	Cl_2	MnO_2

28. Read the given statements and select the option that correctly identifies them as true (T) and false (F) ones.

- I. A solution is a heterogeneous mixture of two or more substances.
- II. The solute particles of a solution can be separated from the mixture by the process of filtration and sedimentation and decantation as well.
- III. The particles of a suspension scatter a beam of light passing through it and make the path of light visible.
- IV. Gel is a type of colloid in which the dispersed phase is a solid, while the dispersion medium is a liquid.

	I	II	III	IV
A.	F	F	T	T
B.	T	T	F	F
C.	F	F	T	F
D.	T	T	F	T

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

Statement 1 : White silver chloride turns grey in sunlight.

Statement 2 : Decomposition of silver chloride occurs in the presence of sunlight to form silver and chlorine.

- A. Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.
B. Both statement 1 and statement 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. Both statement 1 and statement 2 are false.

30. Read the given statements carefully and select the incorrect statement.

- A. The pH of lemon juice and gastric juice is less than 7.
B. Tooth enamel which is made up of calcium hydroxyapatite, is the hardest substance in the body.
C. Orange, tomato and nettle sting are the natural sources of acetic acid, tartaric acid and oxalic acid respectively.
D. Bleaching powder is used for making germ-free drinking water.

31. An element X forms an oxide with formula, X_2O_3 . The formula of its nitrate and sulphate will be respectively

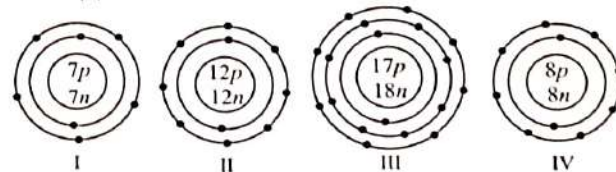
- A. $X(\text{NO}_3)_2$ and $X\text{SO}_4$
B. $X(\text{NO}_3)_3$ and $X_2(\text{SO}_4)_3$
C. $X\text{NO}_3$ and $X\text{SO}_4$
D. $X_2(\text{NO}_3)_3$ and $X(\text{SO}_4)_2$

32. Few organic reactions are listed below. Which of these reactions are named incorrectly?

- I. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{Alkaline KMnO}_4 + \text{Heat}} \text{CH}_3\text{CH}_2\text{COOH}$
(Combustion)
- II. $\text{CH}_4 + \text{Cl}_2 \xrightarrow{h\nu} \text{CH}_3\text{Cl} + \text{HCl}$ (Addition reaction)
- III. $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \xrightleftharpoons{\text{Acid}} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
(Esterification)
- IV. $\text{CH}_3\text{CH}_2\text{OH} + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{heat and light}$
(Substitution reaction)

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

33. Which of the following schematic structures represent(s) anion(s)?



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

34. A brief information regarding two atoms *P* and *Q* is given below :

P - Atomic number = 9; mass number = 19

Q - Atomic number = 11; mass number = 23

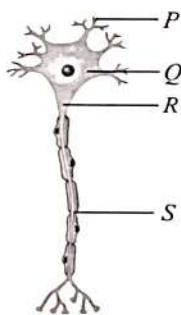
Which of the following is correct about these two atoms?

- A. *P* has same number of neutrons as in Mg.
- B. The difference between the number of neutrons in *P* and *Q* is 4.
- C. The valency of *P* and *Q* is 1.
- D. *P* and *Q* can achieve an octet in their outermost shell by the loss and gain of electron respectively.

35. In plants, ovule bears an opening at its one end generally through which pollen tube enters. This is called

- A. Stigma
- B. Style
- C. Carpel
- D. Micropyle.

36. Refer to the given figure of a neuron. Identify the labelled parts and select the incorrect statement regarding them.



- A. *P* receives stimulus from receptor cells and conducts nerve impulses towards cyton.
- B. Cytoplasm of *Q* is agranular and it transmits impulses towards the dendrites.
- C. *R* conducts nerve impulses away from *Q*.
- D. *S* is an unmyelinated area present at intervals in a myelinated nerve fibres.

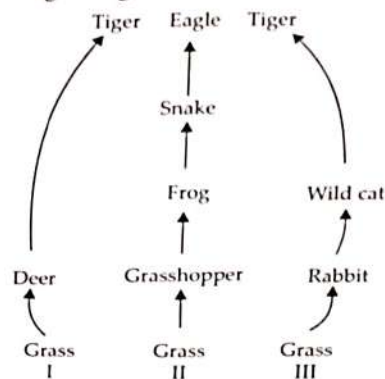
37. Select the correct match.

- A. Abscisic acid - Promotes closing of stomata during stress conditions
- B. Ethylene - Inhibits senescence of leaves
- C. Auxin - Inhibits cell growth
- D. Gibberellin - Inhibits cell differentiation

38. Which of the given diseases is caused due to hypersecretion of a hormone?

- A. Diabetes mellitus
- B. Cretinism
- C. Exophthalmic goitre
- D. Addison's disease

39. Refer to the given food chains and select the correct statement regarding it.



- A. Tiger in food chain I, frog in food chain II and wild cat in food chain III belong to the same trophic level.
- B. Eagle in food chain II and tiger in food chain III are quaternary consumer and tertiary consumer respectively.
- C. In all the given food chains maximum amount of energy is stored in grass.
- D. All of these

40. In a pea plant, seeds may be round (*R*) or wrinkled (*r*). In which of the given crosses maximum number of wrinkled seeds can be yielded in F_1 generation?

- A. $RR \times rr$
- B. $Rr \times Rr$
- C. $Rr \times rr$
- D. $Rr \times RR$

41. Select the incorrect statement.

- A. Economic development is linked to environmental conservation.
- B. The anaerobic destructive distillation of the combustible constituents of the solid wastes at high temperature is called incineration.
- C. Sustainable development does not consider the viewpoints of stakeholders.
- D. Both B and C

42. *X* are the most abundant WBCs present in blood, while *Y* are the least abundant WBCs present in blood. Select the option that correctly identifies *X* and *Y* respectively.

- | <i>X</i> | <i>Y</i> |
|----------------|-------------|
| A. Neutrophils | Basophils |
| B. Neutrophils | Monocytes |
| C. Eosinophils | Lymphocytes |
| D. Basophils | Eosinophils |

43. Role of *Pseudomonas* in nitrogen cycle is to

- A. Convert ammonia into nitrates
- B. Convert nitrate into nitrites
- C. Convert nitrogen containing compounds into ammonia
- D. Convert nitrates into free nitrogen gas.

44. Which of the following is a function of ribosomes?
- They help in manufacture of energy rich molecules.
 - They help in manufacture of protein molecules.
 - They help in detoxification of poisonous chemicals and drugs.
 - They help in manufacture of polysaccharides.
45. Read the following statements carefully and select the option which correctly identifies true (T) and false (F) ones.

- Grafting involves two closely related dicotyledonous plants each having vascular cambium.
 - In ginger, underground stem called rhizome develops into a new plant.
 - Monocystis* reproduces by budding.
 - Mustard flower is an example of unisexual flower.
- | | (i) | (ii) | (iii) | (iv) |
|----|-----|------|-------|------|
| A. | T | T | F | F |
| B. | F | F | F | T |
| C. | T | T | T | F |
| D. | F | T | F | T |

ACHIEVERS SECTION

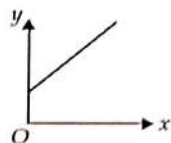
46. The graphs given below are plotted for a convex lens of focal length f , producing a real image at a distance v from the optical centre when a self luminous object is at distance u from the optical centre. The magnitude of magnification is m . These graphs are plotted with the first named physical quantity of column I being along y -axis. Match column I with column II and select the correct option from the given codes.

Column I

Column II

P. v against u

1.



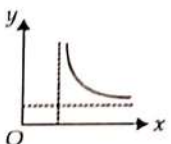
Q. $\frac{1}{v}$ against $\frac{1}{u}$

2.



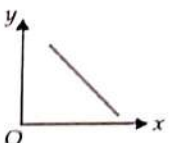
R. m against v

3.



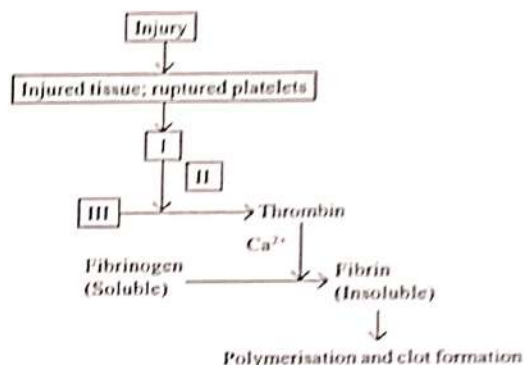
S. $(m + 1)$ against $\frac{v}{f}$

4.



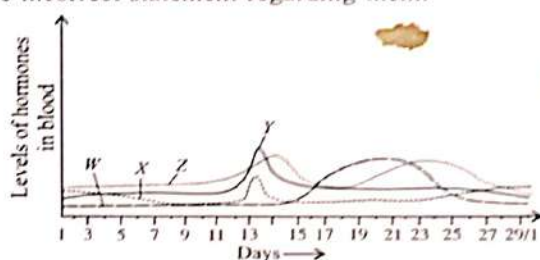
- P-3, Q-4, R-2, S-1
- P-1, Q-3, R-4, S-2
- P-2, Q-1, R-4, S-3
- P-3, Q-1, R-2, S-4

47. Refer to the given flow chart depicting the process of blood clotting where few blanks are given. Select the option that correctly fills in the blanks I-III.



- | | I | II | III |
|----|----------------|-----------|----------------|
| A. | Thromboplastin | Mg^{2+} | Prothrombin |
| B. | Thromboplastin | Ca^{2+} | Prothrombin |
| C. | Prothrombin | Ca^{2+} | Thromboplastin |
| D. | Prothrombin | Vitamin C | Thromboplastin |

48. Identify hormones W-Z in the given graph and select the incorrect statement regarding them.



- High levels of Y stimulate development of corpus luteum.
- Hormone W stimulates further enlargement of endometrium and prepares it for implantation and further development of embryo.
- The developing follicle releases the hormone Z which stimulates repair and development of the lining of uterus and fallopian tube.
- Hormone X secreted from the ovary stimulates ovary to secrete ovum.

49. Megha took three metals, *E*, *F* and *G* and added them into three test tubes containing the following solutions in order to observe the reactivity of the metals. Her observations are summarised in the given table.

Metal	MgSO ₄	FeSO ₄	Al ₂ (SO ₄) ₃
<i>E</i>	✓	✓	✓
<i>F</i>	×	✓	×
<i>G</i>	×	×	×

Which of the following statements are correct?

- I. Among the given metals, *G* is the least reactive metal.
 - II. *F* is more reactive than Fe but less reactive than Mg and Al.
 - III. *E* is more reactive than *F* but less reactive than *G*.
 - IV. *F* can also displace Cu from CuSO₄ solution.
- A. II, III and IV only
 B. I, III and IV only
 C. I, II and IV only
 D. I, II and III only

50. A few reactions are mentioned below.

- I. Reaction of sodium carbonate with hydrochloric acid
 - II. Electrolysis of brine solution
 - III. Heating of baking soda
 - IV. Reaction of plaster of Paris with water
- Now read the given passage and fill in the blanks by selecting an appropriate option.

In reactions *t*, carbon dioxide gas is given out. The reaction of carbon dioxide gas with lime water produces *u*. During process II, *v* gas is liberated that reacts with dry slaked lime to produce *w*. The product formed during reaction IV consists of *x* moles of water.

	<i>t</i>	<i>u</i>	<i>v</i>	<i>w</i>	<i>x</i>
A.	II, III	CaO	H ₂	Ca(OH) ₂	$\frac{1}{2}$
B.	I, III	CaCO ₃	Cl ₂	CaOCl ₂	2
C.	I, IV	Ca(OCl) ₂	H ₂	CaCO ₃	$1\frac{1}{2}$
D.	II, IV	CaCO ₃	Cl ₂	CaCl ₂	$2\frac{1}{2}$

SPACE FOR ROUGH WORK

"myclassroom" platform caters to foundation programs in Science and Maths for middle and senior school students and helps them to secure admission in top academic institutions including IITs, AIIMS, NITs, Government medical colleges, central universities, and top colleges across India. "myclassroom" with its presence across 15 states of India believes that every student has a different learning style and its proprietary AI / ML based adaptive learning platform can bring out the best in every student.


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