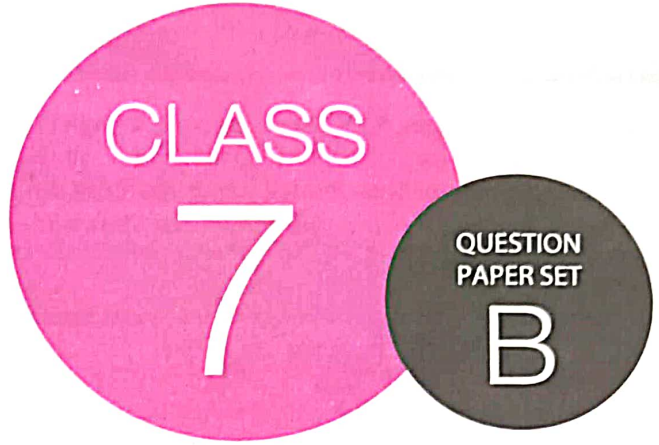


**SOF NATIONAL SCIENCE  
OLYMPIAD 2022-23**

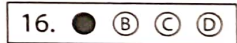


**DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO**

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, 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.
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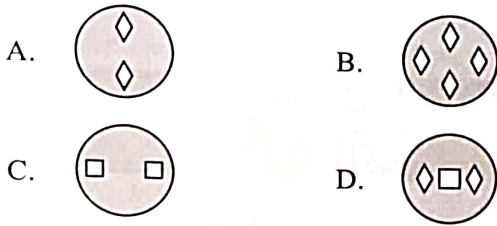
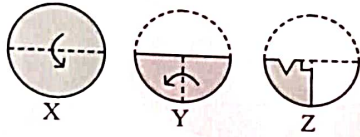


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# LOGICAL REASONING

1. A set of three figures X, Y and Z showing a sequence of folding of a piece of paper is given. Fig. Z shows the manner in which the folded paper has been cut. Select a figure from the options which shows the unfolded form of fig. Z.



2. Pointing towards a man in a photograph, Urvi said "He is the only son of my father's mother-in-law". How is the man related to Urvi?

- A. Father
- B. Cousin
- C. Maternal uncle
- D. Maternal grandfather

3. In a certain code language, 'MASTER' is written as 'BNUTSF'. How will 'REVISION' be written in the same code language?

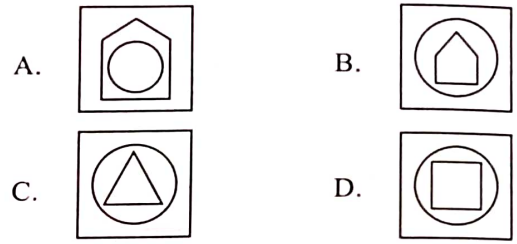
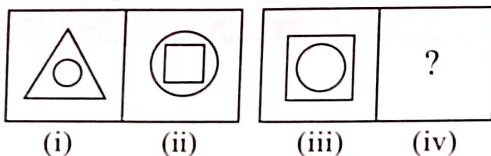
- A. TJPOSFWJ
- B. TGXKUKQP
- C. FSJWJTOP
- D. SFWJTJPO

4. How many K's are there in the given arrangement which are immediately followed by a vowel and immediately preceded by a consonant?

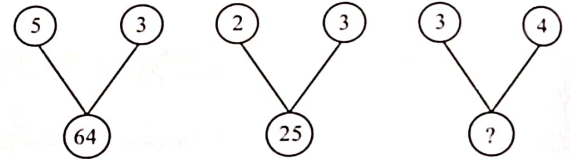
N M P Q A B K U S T K I K U K T V K A K L R S

- A. One
- B. Two
- C. Three
- D. Four

5. There is a certain relationship between figures (i) and (ii). Establish the similar relationship between figures (iii) and (iv) by selecting a suitable figure from the options that would replace the (?) in fig (iv).

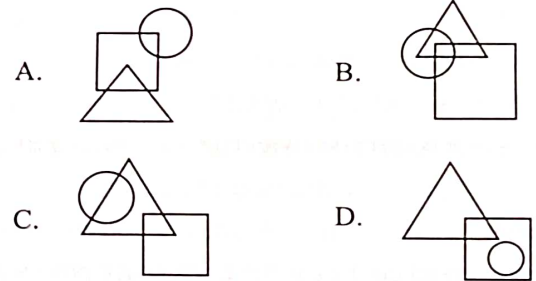
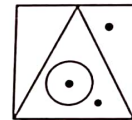


6. Find the missing number, if same rule is followed in all the three figures.



- A. 12
- B. 144
- C. 49
- D. 24

7. Which of the following options satisfies the same conditions of placement of dots as in the given figure?



8. If P means '-', Q means '+', R means '÷' and S means '×', then find the value of 15 P 12 Q 12 R 4 S 3.

- A. 10
- B. 11
- C. 12
- D. 13

9. Town P is to the West of town Q. Town R is to the South of town P. Town S is to the East of town R and South of town Q. In which direction is town S with respect to town P?

- A. North-West
- B. South-East
- C. South-West
- D. North-East

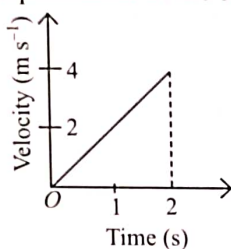


10. Some girls are sitting in a row, Sheetal is sitting 15<sup>th</sup> from the left end and Sapna is 10<sup>th</sup> from the right end. There are 3 girls in between Sheetal and Sapna. How many total girls are sitting in the row, if Sapna is sitting towards the right of Sheetal?

- A. 26  
B. 27  
C. 29  
D. 28

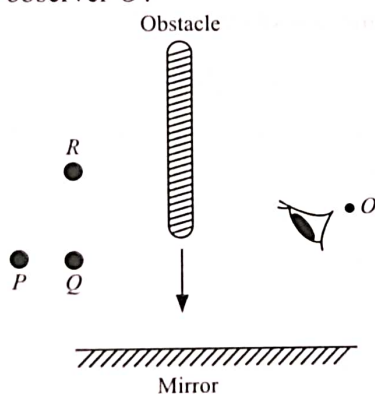
## SCIENCE

11. Velocity-time graph of a car is shown in the given figure. Find the displacement of the car in two seconds.



- A. 1 m  
B. 2 m  
C. 4 m  
D. 8 m

12. Three objects *P*, *Q* and *R* are viewed through a plane mirror as shown in the given figure. When an obstacle is moved towards the mirror, which object will disappear first and which object will disappear last to the observer *O*?



**Disappears first**                      **Disappears last**

- A. *P*    *R*  
B. *R*    *P*  
C. *Q*    *R*  
D. *P*    *Q*

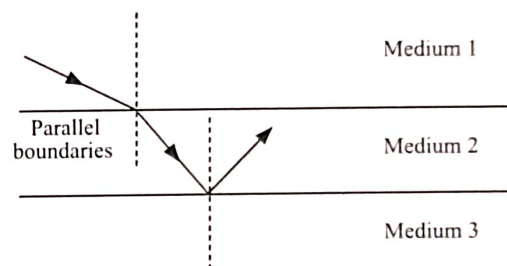
13. When ice changes into water which is at 0°C, then the

- I. Work is done in breaking the molecular structure of ice in solid state.  
II. Energy is absorbed to raise the temperature.  
III. Energy is absorbed to decrease the temperature.

Which of the given statements is/are correct?

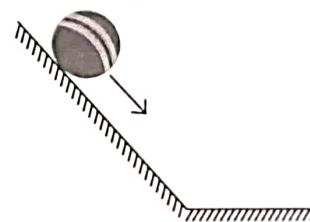
- A. I only  
B. I and II only  
C. II only  
D. I and III only

14. A ray of light travels from medium 1 to medium 2 and is totally internally reflected as shown in the given figure. Which of the following statements is correct?

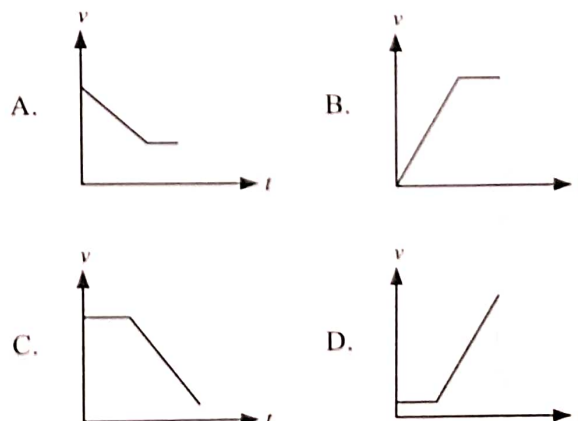


- A. The ray will be refracted towards the normal when it emerges from medium 2 to medium 1.  
B. Medium 2 is denser than mediums 1 and 3.  
C. The ray will again undergo total internal reflection at the boundary between medium 2 and medium 1.  
D. If the angle of incidence in medium 2 is larger, the ray will be able to pass into medium 3.

15. A ball slides down the sloping runway and reaches a smooth flat surface as shown in the given figure.

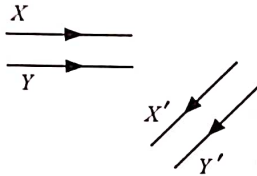


Which of the following velocity(*v*) -time(*t*) graphs best represents motion of the ball?



16. The magnetic field strength of electromagnet
- Can be varied
  - Is constant
  - Can be varied only if the number of turns in the coil is increased
  - None of these.

17. The given figure shows two light rays  $X$  and  $Y$ , being reflected by a mirror and travels as  $X'$  and  $Y'$ . The mirror



- Is plane
  - Is convex
  - Is concave
  - May be any spherical mirror.
18. Sunil and Rohit start at one end of a street (the origin), and run to the other end, then head back. On the way back, Sunil is ahead of Rohit. Which statement is correct about the distances run and the displacements from the origin before reaching the origin?
- Sunil has run a greater distance and his displacement is greater than Rohit's.
  - Rohit has run a greater distance and his displacement is greater than Sunil's.
  - Sunil has run a greater distance but his displacement is lesser than Rohit's.
  - Rohit has run a greater distance but his displacement is lesser than Sunil's.

19. The diagram given below shows the position of a compass needle, when the compass is placed between two strong magnets.



Which of the following combinations is correct for the magnetic poles  $X$  and  $Y$ ?

- |      |          |          |
|------|----------|----------|
|      | <b>X</b> | <b>Y</b> |
| I.   | N        | N        |
| II.  | S        | N        |
| III. | S        | S        |
| IV.  | N        | S        |

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

20. Read the given paragraph with few blanks and select the option that correctly fills these blanks.

A (i) is a giant heat engine, converting the energy of warm ocean air into powerful (ii) and (iii). It is warmer at the centre than the surrounding air. The central low pressure area of a cyclone is called the (iv).

- |    | (i)     | (ii)  | (iii)   | (iv)  |
|----|---------|-------|---------|-------|
| A. | Cyclone | Eye   | Waves   | Winds |
| B. | Eye     | Winds | Cyclone | Waves |
| C. | Cyclone | Winds | Waves   | Eye   |
| D. | Cyclone | Waves | Eye     | Winds |

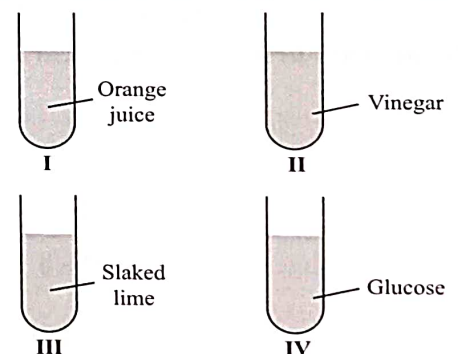
21. The ash which is collected after burning of magnesium ribbon is dissolved in water to give a solution  $X$ . What is the nature of the solution  $X$  when it is tested with indicators?

- It turns blue litmus red and phenolphthalein pink, hence it is an acidic solution.
- It turns red litmus blue and phenolphthalein pink, hence it is a basic solution.
- It turns blue litmus red and gives no colour with phenolphthalein, hence it is an acidic solution.
- It does not change colour of red or blue litmus and phenolphthalein, hence it is a neutral solution.

22. Select the incorrect method of separation.

- Blood cells and plasma - Centrifugation
- Salt and water - Evaporation
- Iron filings and sand - Threshing
- Petrol and water - Separating funnel

23. Mr. Abhishek, a science teacher showed the effect of China rose indicator on the given solutions.



Which of the following options indicates the correct colour change observed in all the test tubes?

- |    | I       | II        | III   | IV        |
|----|---------|-----------|-------|-----------|
| A. | Yellow  | Magenta   | Green | No change |
| B. | Green   | Magenta   | Pink  | Magenta   |
| C. | Magenta | Magenta   | Green | No change |
| D. | Magenta | No change | Green | No change |



24. Two groups of materials are shown below :

- I. Honey and mustard oil
- II. Copper and gold

Identify the property common to each group.

I	II
A. Edible	Poor conductors of heat
B. Edible	Metallic
C. Non-edible	Non-metallic
D. Liquid	Non-metallic

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

Column I	Column II
P. Separating stones from rice	(i) Chemical, irreversible change
Q. Curdling of milk	(ii) Physical, irreversible change
R. Breaking of a flower vase	(iii) Physical, reversible change

- A. P-(ii), Q-(i), R-(iii)
- B. P-(iii), Q-(ii), R-(i)
- C. P-(iii), Q-(i), R-(ii)
- D. P-(i), Q-(iii), R-(ii)

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

**Statement 1 :**  $\text{SO}_2$  gas when dissolved in water turns China rose indicator dark pink/magenta.

**Statement 2 :**  $\text{SO}_2$  is a non-metallic oxide and forms acidic solution in water.

- 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.

27. Select the correct statement.

- A. The evolution of hydrogen gas takes place when vinegar is added to baking soda.
- B. Heat energy is always released during a physical change.
- C. A brown deposit on an iron nail is formed when it is dipped in a blue-coloured copper sulphate solution.
- D. Crystallisation is an example of a chemical change.

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

- I. Red litmus turns blue when dipped in a detergent solution.
- II. Aerated soft drink changes the colour of China rose indicator to green.
- III. Neutralisation reactions involve the evolution of heat.
- IV. Phenolphthalein gives pink colour with window cleaner solution.

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

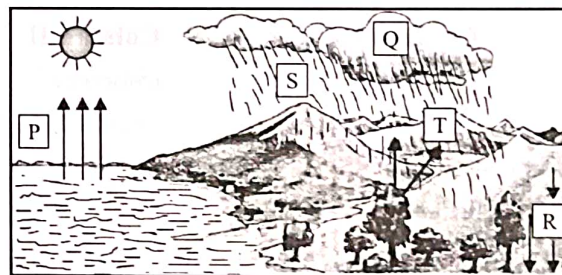
29. Read the given statements and select the correct option.

**Statement 1 :** Cartilage is present at the end of the bones at the joints and upper part of ear.

**Statement 2 :** Cartilage is not a flexible tissue.

- 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.

30. Refer to the given figure and select the incorrect statement.



- A. Q is the process that is responsible for formation of dew drops on leaves.
- B. R is the process that causes rainwater to gather under the ground.
- C. P is the process that is responsible for drying up of water bodies during hot summer days.
- D. Excess of process S could cause drought whereas excess of process T could cause flood.

31. P has fine hair-like structures called cilia, all over its body that help it to obtain food. P could be

- A. Amoeba
- B. Paramecium
- C. Hydra
- D. Yeast

32. Pick out the odd one from X, Y and Z and select the correct option.

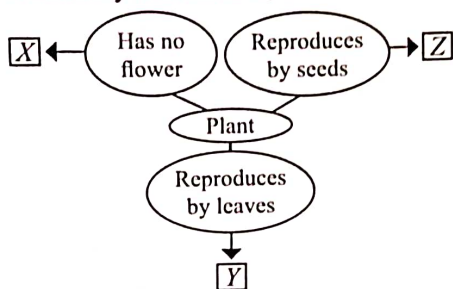
X : Stigma, Style, Anther

Y : Maize, Mustard, Cucumber

Z : Carpel, Sepal, Petal

- |    | X      | Y        | Z      |
|----|--------|----------|--------|
| A. | Style  | Mustard  | Sepal  |
| B. | Stigma | Cucumber | Petal  |
| C. | Anther | Mustard  | Carpel |
| D. | Style  | Maize    | Petal  |

33. Refer to the given flow chart and select the option which correctly identifies X, Y and Z.



- |    | X                  | Y                  | Z              |
|----|--------------------|--------------------|----------------|
| A. | Moss               | <i>Bryophyllum</i> | Maize          |
| B. | Moss               | Ginger             | <i>Begonia</i> |
| C. | <i>Bryophyllum</i> | <i>Begonia</i>     | Moss           |
| D. | Moss               | Onion              | Pineapple      |

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

- | Column I<br>(Vitamin)     | Column II<br>(Source)           |
|---------------------------|---------------------------------|
| P. Vitamin D              | (i) Potato, fish, peanut        |
| Q. Vitamin B <sub>3</sub> | (ii) Papaya, carrot             |
| R. Vitamin C              | (iii) Fish-liver oil, sunlight  |
| S. Vitamin A              | (iv) Citrus fruits, <i>amla</i> |
- A. P-(iii), Q-(i), R-(iv), S-(ii)  
 B. P-(iii), Q-(i), R-(ii), S-(iv)  
 C. P-(i), Q-(ii), R-(iii), S-(iv)  
 D. P-(iii), Q-(ii), R-(iv), S-(i)

35. Read the given statements and select the incorrect one.

- A. Natural fibers are obtained from plants only.  
 B. Cotton fibres that have been separated from the seeds are referred to as lint.  
 C. Yarns are used for making fabrics by the process of knitting or weaving.  
 D. Cotton plant grows best in black soil as it has the ability to retain moisture.

36. Which of the following statements is correct regarding vitamin C?

- A. It keeps the eyes healthy and helps to prevent night blindness.  
 B. Its deficiency causes pellagra.  
 C. It helps to prevent goitre.  
 D. It is richly present in orange and its deficiency causes scurvy.

37. Refer to the given table.

Material	Biodegradable	Can be composted	Can be reused
P	x	x	✓
Q	✓	x	x
R	✓	✓	x
S	x	x	x

Identify P, Q, R and S and select the correct statement regarding them.

- A. P could be metal key.  
 B. Q could be vegetable peel.  
 C. S could be jute bag.  
 D. R could be ceramic bowl.

38. Select the correct statement.

- A. Phloem tubes are only found in the leaves of plants as this is where the sugars are made.  
 B. Anaemia occurs when there is insufficient number of WBCs.  
 C. Blood contains many more white blood cells than red blood cells.  
 D. None of these

39. Which of the following plant parts is not responsible for gaseous exchange?

- A. Stomata  
 B. Root surface  
 C. Lenticels  
 D. None of these

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

- I. Chloroplast is the green pigment found in leaves that helps in photosynthesis.  
 II. Mushroom is an insectivorous plant.  
 III. Process of intake of food and its utilisation is called digestion.

- |    | I | II | III |
|----|---|----|-----|
| A. | F | F  | F   |
| B. | F | T  | T   |
| C. | T | F  | F   |
| D. | T | T  | F   |



41. Refer to the given statements about an animal.

- It has thick and long hair on its body.
- It has large chest and lungs.
- It has strong hooves and horns.

Identify the animal and select the correct option.

- A. Snow leopard
- B. Yak
- C. Lion
- D. Camel

42. Which of the following is an advantage of vegetative propagation?

- A. The characters of a species can be conserved by this method.
- B. Plants with reduced or no sexual reproduction can be multiplied by this method.
- C. This method is rapid, easier and less expensive for obtaining a large number of progenies.
- D. All of these

43. Forests are a good source of

- A. Timber
- B. Medicinal plants

- C. Resin and gum
- D. All of these.

44. Identify animal *X* from the given figure and select the correct statement regarding it.



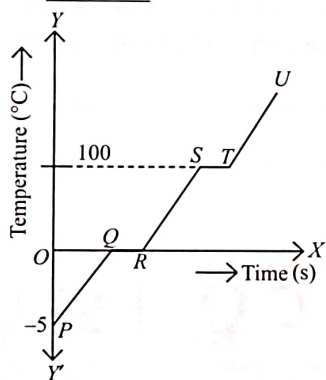
- A. *X* has flaps in its nostrils to avoid entry of dust.
- B. *X* does not drink water to fulfill its water requirement, it uses the metabolic water produced in its body by oxidation of food.
- C. *X* has thick layer of fur to protect itself from cold.
- D. *X* has strong claws to dig snow for food.

45. Which of the following options contains correct equation for aerobic respiration?

- A.  $C_6H_{12}O_6 + 6O_2 \rightarrow CO_2 + C_2H_5OH + \text{Energy}$
- B.  $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + \text{Energy}$
- C.  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$
- D. None of these

### ACHIEVERS SECTION

46. The heating curve of a particular substance in solid state is as shown in the given figure. *RS* part of the graph indicates \_\_\_\_\_ state of the substance.



- A. A liquid
- B. A solid
- C. A gaseous
- D. Either a liquid or a gaseous

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

Reaction of acetic acid with sodium hydrogen carbonate is an example of a (i) change. (ii) gas is evolved during this reaction that turns

(iii) milky. The milkiness of (iii) is due to the formation of (iv).

- |    | (i)          | (ii)            | (iii)      | (iv)                |
|----|--------------|-----------------|------------|---------------------|
| A. | Irreversible | CO <sub>2</sub> | Limewater  | Ca(OH) <sub>2</sub> |
| B. | Chemical     | H <sub>2</sub>  | Quick lime | CaSO <sub>4</sub>   |
| C. | Irreversible | H <sub>2</sub>  | Quick lime | CaSO <sub>4</sub>   |
| D. | Chemical     | CO <sub>2</sub> | Limewater  | CaCO <sub>3</sub>   |

48. Read the given paragraph and select the correct statement regarding it.

In human beings, there are various types of teeth present in the mouth for tearing, cutting and chewing. *X* type of teeth are for biting and cutting. *Y* type of teeth are used for crushing and grinding, and are absent in milk teeth set. *Z* type of teeth are used for tearing the food.

- A. *X* are total 6 in number in the mouth of an adult.
- B. *Y* are total 2 in number in the upper jaw of an adult.
- C. *Z* are total 6 in number in the lower jaw of an adult.
- D. *X*, *Y* and *Z* are total 10 in number in the upper jaw of an adult.

49. Refer to the given word grid.

A	O	N	P	T	S	L	I	H	A
B	R	O	N	C	H	I	T	I	S
D	S	Y	O	S	V	Z	U	G	T
Q	N	S	J	P	R	D	S	N	H
R	A	N	G	Q	S	R	T	U	M
S	K	F	I	S	H	D	W	V	A
T	E	P	S	C	U	R	V	Y	X
Y	Z	L	M	N	O	P	Q	R	S

Select the option that correctly answers the following questions.

- (a) Names of how many respiratory diseases can be found in the given word grid?
- (b) Names of how many animals showing branchial respiration can be found in the given word grid?

- |    |     |     |
|----|-----|-----|
|    | (a) | (b) |
| A. | 2   | 3   |
| B. | 3   | 3   |
| C. | 3   | 2   |
| D. | 2   | 1   |

50. Unscramble the letters given in column I, match them with column II and select the correct option from the given codes.

- | Column I      | Column II                                    |
|---------------|--|
| (i) SLPAMA    | (a) Prevent backflow of blood                |
| (ii) SAVVLE   | (b) Structural and functional unit of kidney |
| (iii) ENHONPR | (c) Waste product of older plants            |
| (iv) EALTX    | (d) Fluid part of blood                      |
- A. (i)-(a), (ii)-(b), (iii)-(c), (iv)-(d)  
 B. (i)-(c), (ii)-(d), (iii)-(a), (iv)-(b)  
 C. (i)-(d), (ii)-(a), (iii)-(b), (iv)-(c)  
 D. (i)-(d), (ii)-(c), (iii)-(b), (iv)-(a)

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
  
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