

CLASS

9

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. Two billiard balls  $X$  and  $Y$ , each of mass  $75\text{ g}$  are moving in opposite directions with a speed of  $10\text{ m s}^{-1}$  each. They collide and rebound with the same speed. If the collision lasts for  $10^{-3}\text{ s}$ , then which of the following statements is/are true?
- The impulse imparted to each ball is  $0.75\text{ N s}$  and the force exerted on each ball is  $250\text{ N}$ .
  - The impulse imparted to each ball is  $1.5\text{ N s}$ .
  - The impulse and the force on each ball are equal in magnitude and opposite in direction.
  - Both B and C.

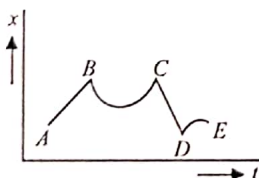
2. Read the given statements and select the correct option.
- Statement 1 :** A thief jumped from a building with a box of mass  $15\text{ kg}$  on his head. During the fall, the weight of box felt by the thief is  $150\text{ N}$ .
- Statement 2 :** Mass of an object is constant everywhere.
- Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
  - Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
  - Statement 1 is true but statement 2 is false.
  - Statement 1 is false but statement 2 is true.

3. Three blocks  $P$ ,  $Q$  and  $R$ , of masses  $5\text{ kg}$ ,  $3\text{ kg}$  and  $1\text{ kg}$  respectively, are in contact on a frictionless surface as shown in the figure. If a force of  $18\text{ N}$  is applied on the  $5\text{ kg}$  block, then the contact force between  $P$  and  $Q$  is
- $8\text{ N}$
  - $4\text{ N}$
  - $2\text{ N}$
  - $6\text{ N}$



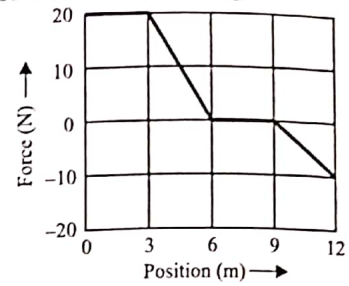
4. Sound waves travel at  $350\text{ m s}^{-1}$  through warm air and at  $3500\text{ m s}^{-1}$  through brass. The wavelength of a  $900\text{ Hz}$  acoustic wave as it enters warm air from brass
- Decreases by a factor 10
  - Increases by a factor 20
  - Increases by a factor 10
  - Decreases by a factor 20.

5. Figure shows the displacement ( $x$ ) of a particle going along a straight line as function of time ( $t$ ). The force acting on the particle is zero in the region



- $AB$
  - $BC$
  - $CE$
  - $DE$ .
6. A  $6.0\text{ kg}$  block moves in a straight line on a horizontal frictionless surface under the influence of a force that varies with position as shown in the figure. How

much work is done by the force as the block travels a distance of  $9\text{ m}$  from starting?



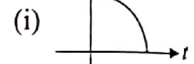
- $60\text{ J}$
- $90\text{ J}$
- $120\text{ J}$
- $135\text{ J}$

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

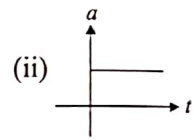
**Column I**

**Column II**

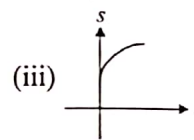
- (a) Uniform velocity



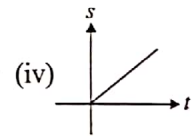
- (b) Uniform acceleration



- (c) Uniform retardation



- (d) Non-uniform retardation



- (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)
- (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)
- (a) - (iv), (b) - (ii), (c) - (iii), (d) - (i)
- (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)

8. A boy moves on his motorbike with constant speed of  $54\text{ km h}^{-1}$ . After some time, he takes a U turn and continues to move with the same speed. Time elapsed in taking U turn is  $20\text{ s}$ . The magnitude of average acceleration during U turn is

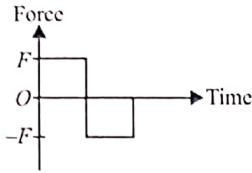
- Zero
- $2.70\text{ m s}^{-2}$
- $1.50\text{ m s}^{-2}$
- $5.4\text{ m s}^{-2}$

9. An object is released from a height  $h$ . At a certain height, its kinetic energy is  $\left(\frac{3}{5}\right)^{\text{th}}$  of its potential energy. The speed of the particle at that instant is

- $\sqrt{\frac{2gh}{5}}$
- $2\sqrt{\frac{gh}{3}}$
- $\sqrt{\frac{2gh}{7}}$
- $\sqrt{\frac{3}{4}gh}$

10. In the first second of its flight, a rocket ejects  $1/40$  of its mass with a velocity of  $1200 \text{ m s}^{-1}$ . The acceleration of the rocket is
- A.  $20 \text{ m s}^{-2}$                       B.  $30 \text{ m s}^{-2}$   
 C.  $40 \text{ m s}^{-2}$                       D.  $60 \text{ m s}^{-2}$

11. A person used a variable force, shown in the figure to move a load with constant speed on a surface. Identify the correct surface profile. (Ignore the friction between load and surface.)



- A.                      B.   
 C.                      D.

12. A body projected vertically from the surface of the earth, reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force
- A. Is greatest at the highest position of the body  
 B. Is greatest at the instant just before the body hits the earth  
 C. Remains constant throughout the motion  
 D. None of these.

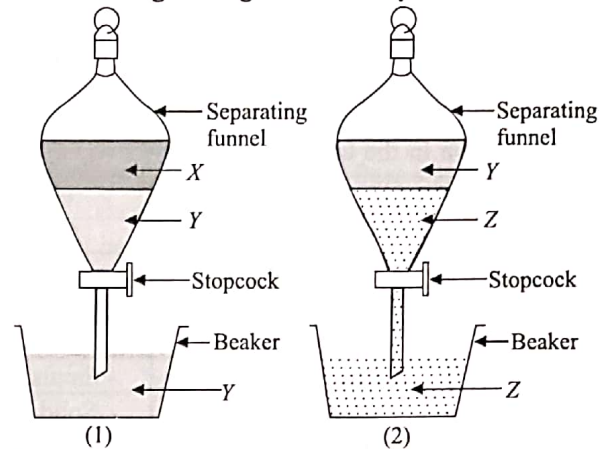
13. The force acting on a window of area  $50 \text{ cm} \times 50 \text{ cm}$  of a submarine at a depth of  $2000 \text{ m}$  in an ocean, interior of which is maintained at sea level atmospheric pressure is  
 (Density of sea water =  $10^3 \text{ kg m}^{-3}$ ,  $g = 10 \text{ m s}^{-2}$ )
- A.  $5 \times 10^5 \text{ N}$                       B.  $25 \times 10^6 \text{ N}$   
 C.  $25 \times 10^5 \text{ N}$                       D.  $5 \times 10^6 \text{ N}$

14. Two floats  $P$  and  $Q$  are  $22.5 \text{ m}$  apart in a lake. A disturbance at a point in line with the floats sends out a train of waves along the surface of the water, so that the floats move up and down 20 times per minute. When float  $P$  is on the crest of a wave, float  $Q$  is in a trough and there is one other crest between them. What is the speed of the waves?
- A.  $5 \text{ m s}^{-1}$                       B.  $15 \text{ m s}^{-1}$   
 C.  $300 \text{ m s}^{-1}$                       D.  $450 \text{ m s}^{-1}$

15. Read the given statements and select the correct option.
- Statement 1 :** The acceleration due to gravity on the moon is only one sixth of that on the earth. If the earth and the moon are assumed to have same density, then the ratio of the radii of the moon and the earth would be  $1 : 36$ .
- Statement 2 :** Acceleration due to gravity of a planet does not depend upon its density.

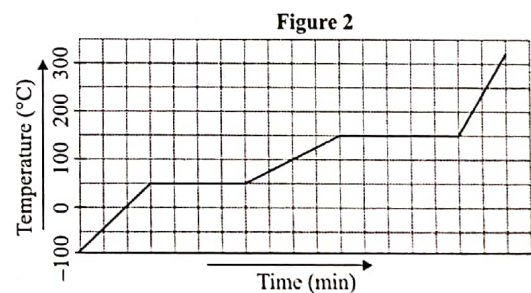
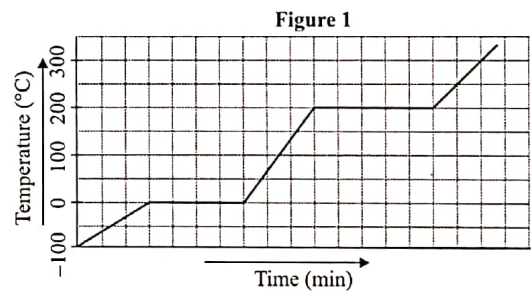
- A. Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.  
 B. Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.  
 C. Statement 1 is true but statement 2 is false.  
 D. Both statements 1 and 2 are false.

16. Observe the given figures carefully.



- $X$ ,  $Y$  and  $Z$  could be respectively
- A. Water, alcohol and acetone  
 B. Mustard oil, water and mercury  
 C. Coconut oil, water and alcohol  
 D. Water, mercury and mustard oil.

17. Figures 1 and 2 represent the heating curves for substances  $U$  and  $V$  respectively.



What conclusion can be drawn regarding the melting points and boiling points of substances  $U$  and  $V$ ?

- A. Substance  $U$  has higher melting point and higher boiling point than substance  $V$ .  
 B. Substance  $V$  has higher melting point and higher boiling point than substance  $U$ .  
 C. Substance  $U$  has higher melting point but substance  $V$  has higher boiling point.  
 D. Substance  $V$  has higher melting point but substance  $U$  has higher boiling point.

18. A brief information about three elements  $P$ ,  $Q$  and  $R$  is given here.

$P$  : It is the smallest element with zero valency.

$Q$  : It has three protons more than that of  $P$ .

$R$  : It has one extra shell and three more valence electrons than that of  $Q$ .

Elements  $P$ ,  $Q$  and  $R$  could be respectively \_\_\_\_\_.

- A. H, Cl and Si                      B. Ne, Al and S  
C. He, B and S                        D. H, N and P

19. Gaurav, a class 9 student classified a few mixtures as shown in the table.

S. No.	Mixture	Type
I	Whipped cream	Foam
II	Blood	Gel
III	Milk	Emulsion
IV	Clouds	Aerosol
V	Acetic acid in water	Emulsion
VI	Muddy water	Solid sol

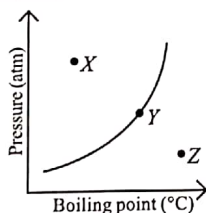
The mixtures classified correctly are

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

20. Four atoms are represented as :  ${}_{z_1}^{a_1}P$ ,  ${}_{z_2}^{a_2}Q$ ,  ${}_{z_3}^{a_3}R$  and  ${}_{z_4}^{a_4}S$ . If  $z_1 = z_3$ ;  $a_1 \neq a_3$ ;  $z_2 \neq z_4$  and  $a_2 = a_4$ ; then which of the following represents the correct pairs of isotopes and isobars?

- | Isotopes  | Isobars |
|-----------|---------|
| A. $P, S$ | $Q, R$  |
| B. $R, S$ | $P, Q$  |
| C. $P, R$ | $Q, S$  |
| D. $Q, R$ | $P, S$  |

21. The given graph shows the variation of boiling point of water with pressure.



Which of the following statements is correct regarding the states of water at points  $X$ ,  $Y$  and  $Z$ ?

- A. Water exists both in gaseous and liquid states at point  $X$ .  
B. Water exists in liquid state at point  $Z$ .  
C. Water exists both in gaseous and liquid states at point  $Y$ .  
D. Water exists in liquid state at point  $X$ , in solid state at point  $Y$  and in gaseous state at point  $Z$ .
22. Natural water is impure and needs to be purified before this water can be supplied to homes for drinking purposes. The sequence of steps involved in purification of water is

- A. Filtration, sedimentation, decantation and aeration  
B. Sedimentation, loading, filtration and chlorination  
C. Chlorination, aeration, sedimentation and filtration  
D. Chlorination, filtration and distillation.

23. Boiling points of some gases are given in the table.

Gas	Boiling point (°C)
$P$	-269
$Q$	-162
$R$	-246
$S$	-183
$T$	-108

The gases that are in the liquid state at  $-200^\circ\text{C}$  are

- A.  $P$  and  $S$  only                      B.  $P, R$  and  $T$  only  
C.  $Q, S$  and  $T$  only                  D.  $P, Q, S$  and  $T$  only.
24. Which of the following represents the given samples in increasing order of their mass in grams? (Atomic mass of  $\text{Ca} = 40 \text{ u}$ ,  $\text{C} = 12 \text{ u}$ ,  $\text{O} = 16 \text{ u}$ ,  $\text{H} = 1 \text{ u}$ )
- I.  $6.022 \times 10^{22}$  molecules of  $\text{CaCO}_3$   
II. 0.5 mole of  $\text{O}_2$   
III.  $10^{23}$  molecules of  $\text{CH}_4$   
IV. 1.5 moles of  $\text{Ca}$
- A. III < II < I < IV                  B. II < IV < III < I  
C. I < III < IV < II                  D. III < I < II < IV

25. Steam at  $100^\circ\text{C}$  is a more effective heating agent than water at the same temperature because 1 kg of steam at  $100^\circ\text{C}$  has \_\_\_\_\_ more energy than 1 kg of water at the same temperature.
- A. 40.2 J                                  B.  $52.5 \times 10^6 \text{ J}$   
C.  $22.5 \times 10^5 \text{ J}$                       D. 80.4 J

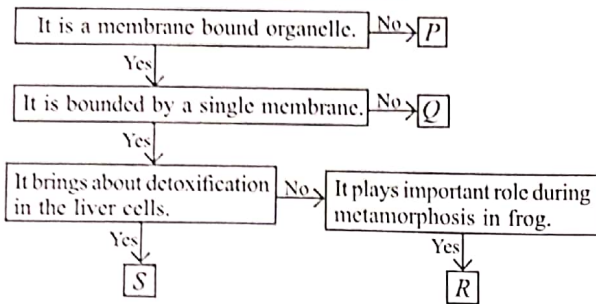
26. Elements  $W$ ,  $X$  and  $Y$  have valencies 1, 3 and 4 respectively. Formula unit masses of their oxides are 62, 102 and 64 respectively. If atomic mass of  $Y$  is divided by the difference in atomic masses of  $W$  and  $X$  then value obtained is the atomic number of an element having valency \_\_\_\_\_.
- A. 3    B. 2  
C. 1    D. 0

27. Select the incorrect statement(s) about the plasma state of matter.
- I. This state consists of super-energetic and super-excited particles.  
II. The particles of plasma state are in the form of ionised gases.  
III. Plasma is used in neon signs and fluorescent lights.  
IV. Colour of plasma glow does not depend on the nature of the gas.
- A. I, II and III only                      B. II only  
C. II and III only                        D. IV only

28. Which of the following samples has the maximum number of atoms? (Given : Atomic mass of  $\text{Fe} = 56 \text{ u}$ ,  $\text{H} = 1 \text{ u}$ ,  $\text{N} = 14 \text{ u}$ ,  $\text{O} = 16 \text{ u}$ ,  $\text{C} = 12 \text{ u}$  and  $\text{He} = 4 \text{ u}$ )



35. Refer to the given flow chart and select the correct statement regarding P, Q, R and S.



- A. P could bear ATP-generating oxysomes whereas Q could be absent in sieve tubes of plants.  
 B. R could provide an internal source of nutrients for energy generation during starvation whereas S could provide surface for synthesis of steroid hormones.  
 C. P could help in synthesis of proteins whereas R could secrete enzymes which are used for breaking limiting membrane of eggs.  
 D. Both B and C

36. Take a clean glass slide and put few drops of water on it. Now place a complete *Rheo* leaf on water droplets and examine the cells of leaf under the high power of compound microscope. Put a few drops of concentrated salt/sugar solution on the mounted *Rheo* leaf on the glass slide. Wait for few minutes and again observe the leaf under the high power of microscope.

What will be your observation after few minutes?

- A. Cell contents are separated from the cell wall.  
 B. Cytoplasm along with plasma membrane has come to lie on one side of cell wall.  
 C. A clear space is seen between the cell wall and protoplast of the cells.  
 D. All of these

37. Complete the given statements by selecting the correct words from the given options.

- (a) (i) is a kind of manure which is prepared in the field itself to enrich soil with nitrogen and phosphorus.  
 (b) (ii) is a draught breed of cattle.  
 (c) In (iii) water escapes from revolving nozzle and falls like rain on the crops.  
 (d) (iv) is the process of crossing individuals of two different species to produce hybrid.

	(i)	(ii)	(iii)	(iv)
A.	Vermi-compost	Malvi	Drip irrigation	Intravarietal hybridisation
B.	Farm yard manure	Sahiwal	Chain pump	Intervarietal hybridisation
C.	Compost	Gir	Moat	Intraspecific hybridisation
D.	Green manure	Nagori	Sprinkler system	Interspecific hybridisation

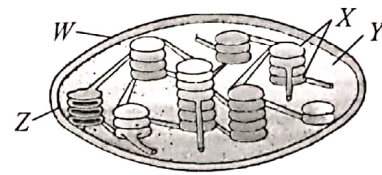
38. Read the given paragraph.

AIDS is caused by a (i) and affects immune system. (ii) is caused by *Leishmania* which lives as intracellular parasite in cells of spleen and bone marrow. Sleeping sickness is caused by *Trypanosoma* and its target organ is (iii).

Select the correct sequence of terms to complete the above paragraph.

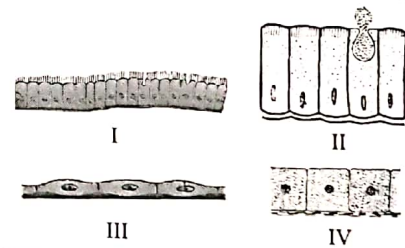
	(i)	(ii)	(iii)
A.	Retrovirus	Kala-azar	Brain
B.	Retrovirus	Hepatitis-A	Liver
C.	Coronavirus	Bubonic plague	Spleen
D.	Coronavirus	Diarrhoea	Brain

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



- A. W is selectively permeable whereas Z is freely permeable to small molecules.  
 B. X contains the green pigment molecules and is the site of dark reaction during photosynthesis.  
 C. Y is a green coloured, agranular substance where dark reaction takes place during photosynthesis.  
 D. X is the site of light reaction whereas Y is the site of dark reaction during photosynthesis.

40. The given figure shows four different types of epithelium. Select the correct option regarding this.



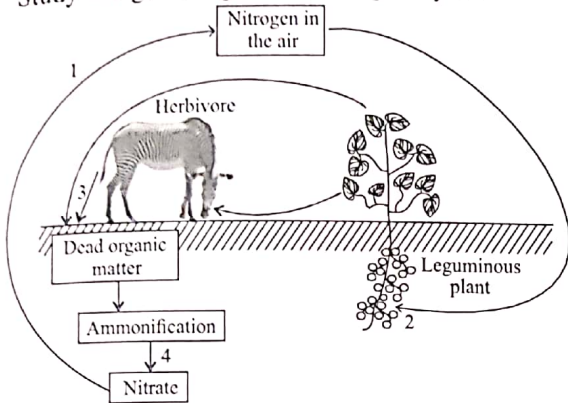
- A. IV lines the glands such as gastric glands, intestinal glands and pancreatic lobules.  
 B. III is found in fallopian tubes.  
 C. II is found in outer skin layer of sole and palm and is protective in function.  
 D. I lines nasal passages, terminal bronchioles and ventricles of the brain.

41. Read the given statements regarding composite fish culture system and select the correct option regarding them.

- I. P feeds on zooplanktons and lives mostly in the surface zone.  
 II. Q lives in the middle zone whereas R lives at bottom.

- III. *S* feeds on decaying plants and lives in the middle zone.
- A. *P* could be catla whereas *S* could be rohu.  
 B. *P* could be silver carp whereas *Q* could be mrigal.  
 C. *Q* could be common carp whereas *R* could be rohu.  
 D. All of these

42. Study the given figure of nitrogen cycle.



Identify the location of nitrifiers, denitrifiers and nitrogen fixers in the cycle and select the correct option from the codes given below.

- A. 1-Nitrifiers, 2-Denitrifiers, 3-Nitrogen fixers  
 B. 1-Denitrifiers, 2-Nitrogen fixers, 4-Nitrifiers  
 C. 2-Nitrifiers, 3-Denitrifiers, 4-Nitrogen fixers  
 D. 1-Denitrifiers, 2-Nitrifiers, 4-Nitrogen fixers

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

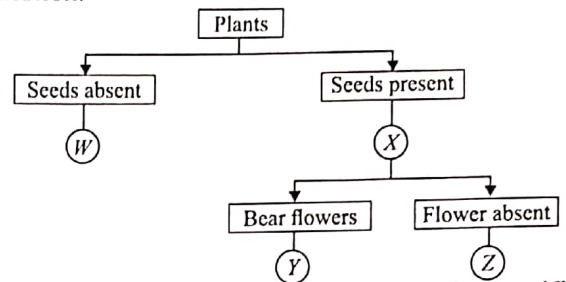
**Statement 1 :** Measles can be treated by taking antibiotics.

**Statement 2 :** Antibiotics block the biochemical life processes of viruses.

- 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.

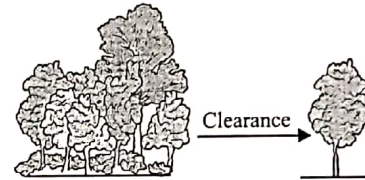
44. Refer to the given flow chart and answer the following question.



Which of the following options correctly identifies W, X, Y and Z?

- |    | W           | X           | Y              | Z               |
|----|-------------|-------------|----------------|-----------------|
| A. | Cryptogams  | Phanerogams | <i>Cycas</i>   | <i>Pinus</i>    |
| B. | Cryptogams  | Phanerogams | <i>Ephedra</i> | <i>Cicer</i>    |
| C. | Phanerogams | Cryptogams  | <i>Oryza</i>   | <i>Triticum</i> |
| D. | Phanerogams | Cryptogams  | <i>Pisum</i>   | <i>Thuja</i>    |

45. The given diagram shows a tropical forest before and after the clearance.

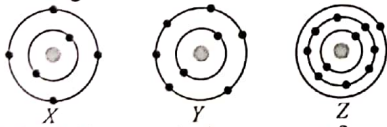


Which of the following could not be the outcome of this clearance?

- A. Soil will turn acidic because minerals present in the soil will be used more.  
 B. Desertification will occur because all plants have been removed.  
 C. Soil erosion will speed up.  
 D. Both A and B

## ACHIEVERS SECTION

46. Schematic atomic structures of three elements X, Y and Z are given below.



Which of the following is the correct formula of the compound formed by these three elements?

- A.  $Z_3YX_4$   
 B.  $Z_2XY_3$   
 C.  $Z_2YX_4$   
 D.  $Z_2YX_2$

47. Refer to the given paragraph where few words have been italicised.

*Biomagnification* is the process by which excessive growth of algae occurs due to presence of sewage and fertilisers in water bodies. It occurs mainly due to *sulphates* and *phosphates*. It results in algal bloom. After some time submerged plants subsequently die and *anaerobic* decomposer bacteria become active.

They consume dissolved oxygen and hence aquatic life is affected.

*Eutrophication* is the *decrease* in concentration of non-biodegradable chemical substances at each trophic level in the food chain. It mainly affects organisms present at the *lowest* level in the food chain.

Select the correct statement regarding this.

- A. *Biomagnification* and *eutrophication* should be interchanged and *decrease* should not be replaced as it is correctly mentioned.  
 B. *Sulphates* should be replaced by *nitrates* and *phosphates* should not be replaced as it is correctly mentioned.  
 C. *Anaerobic* and *biomagnification* must not be replaced as they are correctly mentioned.  
 D. *Anaerobic* should be replaced with *aerobic* and *lowest* should not be replaced as it is correctly mentioned.

