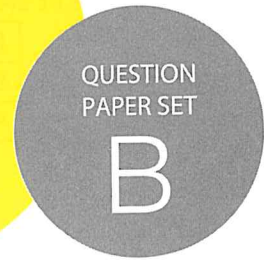


**SOF NATIONAL SCIENCE
OLYMPIAD 2019-20**



DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Name:.....

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

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. 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. Find the missing character, if a certain rule is followed either row-wise or column-wise.

B	G	N
D	J	R
H	P	?

- A. Z
 B. V
 C. W
 D. X
-
2. If two is subtracted from each of the following numbers, then which of the following is the sum of the second digit of the second highest number and the second digit of the highest number?

486 441 634 932 873

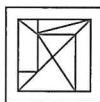
- A. 8
 B. 3
 C. 7
 D. 10
-
3. Select the correct mirror image of the given combination, if the mirror is placed vertically to the left.

PoWeR loGic

- A.
 B.
 C.
 D.
-
4. In a certain code language, GYPSUM is written as GMPSUY. How will GARDEN be written in that language?
- A. ADENGR
 B. ADEGRN
 C. ADEGNR
 D. GEDANR

5. Ashwini is facing towards South-West. He turns 180° clockwise and then turns 90° anti-clockwise. Finally he turns 315° clockwise. In which direction is he facing now?
- A. North
 B. North-West
 C. West
 D. South-East

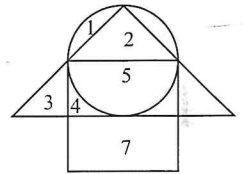
6. Select a figure from the options which is exactly embedded in the given figure as one of its parts.



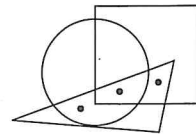
- A. B.
 C. D.

7. In the given Venn diagram, square represents people who like to play badminton, circle represents people who like to play cricket and triangle represents people who like to watch movies. Which of the following numbers represents people who like to play cricket as well as watch movies but do not like to play badminton?

- A. 4
 B. 5
 C. 2
 D. 3



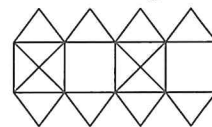
8. Select a figure from the options which satisfies the same conditions of placement of the dots as in the given figure.



- A. B.
 C. D.

9. Shivam points to a photograph and says, "The woman is my niece's maternal grandmother". How is the woman in the photograph related to Shivam's brother who has no other sibling?
- A. Sister-in-law
 B. Mother
 C. Mother-in-law
 D. Can't be determined

10. Count the number of triangles in the given figure.



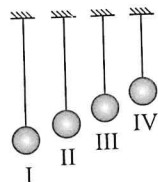
- A. 20
 B. 18
 C. 22
 D. None of these

11. Which of the following pairs relating different units are true?

- I. 40 cm = 4 dm
 - II. 20 m = 2000 km
 - III. 30 mm = 3000 cm
 - IV. 10 m = 100 dm
- A. I and II only B. II and III only
C. III and IV only D. I and IV only

12. There are four pendulums as shown in the given figure. Which of the following pendulums has the shortest time period?

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



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

Column I

Column II

- (a) (i) Rectilinear motion
- (b) (ii) Periodic motion
- (c) (iii) Oscillatory motion

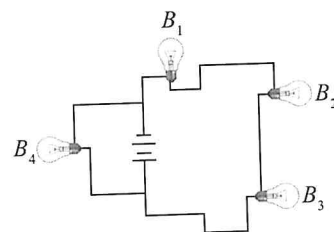
- A. (a)-(i); (b)-(ii); (c)-(ii), (iii)
B. (a)-(iii); (b)-(i), (iii); (c)-(ii)
C. (a)-(ii); (b)-(ii); (c)-(ii), (iii)
D. (a)-(ii); (b)-(iii); (c)-(ii), (iii)

14. You are standing upright in a room in front of a vertical plane mirror. In this mirror, you can see from your position, only the upper two-third part of your body. You wish to see the full image of your body in the mirror. By which of the following actions we can achieve this?

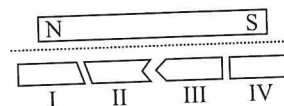
- I. Move away from the mirror.
 - II. Move towards the mirror.
 - III. Use a mirror whose height will allow you to see your full image.
- A. I only B. II only
C. III only D. I and II only

15. There are four identical bulbs B_1, B_2, B_3 and B_4 in the given circuit. Which bulb has the maximum brightness?

- A. B_1
B. B_2
C. B_3
D. B_4



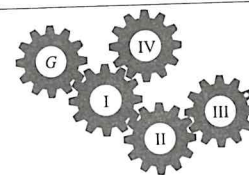
16. A bar magnet has been broken into four pieces I, II, III and IV.



Which of the following options shows the correct poles in broken pieces?

- A. $\boxed{N \ N} \ \boxed{S \ S} \ \boxed{N \ N} \ \boxed{S \ S}$
B. $\boxed{N \ S} \ \boxed{S \ N} \ \boxed{N \ S} \ \boxed{S \ N}$
C. $\boxed{N \ S} \ \boxed{N \ S} \ \boxed{N \ S} \ \boxed{N \ S}$
D. $\boxed{S \ N} \ \boxed{S \ N} \ \boxed{N \ S} \ \boxed{N \ S}$

17. In the given gear system, if gear G rotates in clockwise direction, then which of the gears rotate in clockwise direction?



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

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

Statement 1 : Sound is produced by vibrating objects.
Statement 2 : Sound is a form of energy.

- 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. A motorcycle is accelerating on a level road. What will happen to its kinetic energy and heat produced in its tyres during motion?

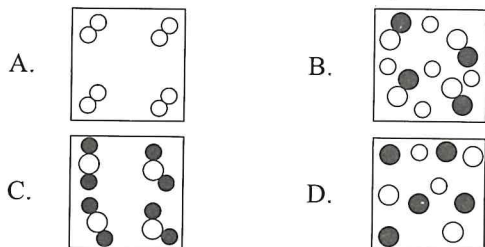
- | Kinetic energy | Heat produced |
|----------------|---------------|
| A. Increase | Increase |
| B. Increase | Decrease |
| C. Decrease | Decrease |
| D. Decrease | Increase |

20. Which of the following forces is/are able to act from a distance?

- I. Gravitational force
 - II. Magnetic force
 - III. Electric force
- A. I only B. II only
C. I, II and III D. II and III only

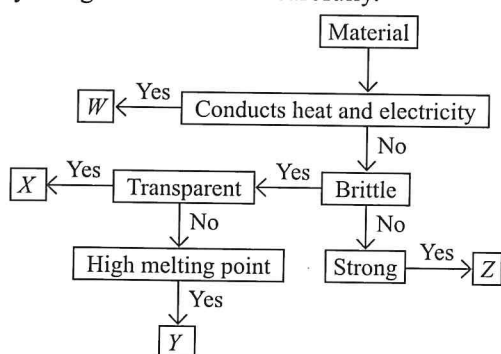
21. A science teacher labelled three glass slides as *P*, *Q* and *R*. She painted slide *Q* with light blue colour, slide *R* with black colour and slide *P* was left as such. Then she asked students to put the slide on a white paper having (X) mark on it. Students will be able to see the mark clearly or partially
- In slide *P* as it is translucent
 - In slide *Q* as it is translucent
 - In slide *R* as it is opaque
 - In all the slides as paint does not change the nature of glass.

22. Which of the following diagrams best represents a mixture of an element and a compound?



23. Select the correct statements.
- Sublimation of camphor at ordinary temperature is a physical and slow change.
 - Rusting of iron is a chemical and fast change.
 - Bursting of crackers is a physical and fast change.
 - Glowing of an incandescent light bulb is a physical and fast change.
 - Spoilage of food is a chemical and slow change.
- II and III only
 - IV and V only
 - I, IV and V only
 - II, III and V only

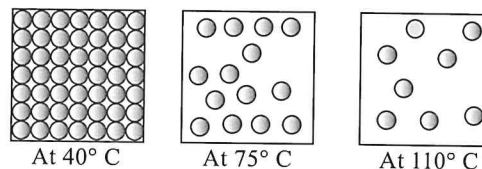
24. Study the given flow chart carefully.



Which of the following best identifies the materials *W*, *X*, *Y* and *Z*?

- | | <i>W</i> | <i>X</i> | <i>Y</i> | <i>Z</i> |
|----|----------|--------------|---------------|-------------|
| A. | Iron | Clay pot | Wooden log | Glass door |
| B. | Copper | Window glass | Ceramic plate | Wooden log |
| C. | Plastic | Water | Glass door | Copper vase |
| D. | Iron | Window glass | Wooden log | Clay pot |

25. The given figures show arrangement of particles of a substance '*X*' at different temperatures.



- Which of the following statements is incorrect?
- Substance *X* exists as a solid at 25°C.
 - Substance *X* will have definite shape and definite volume at 85°C.
 - Substance *X* will have higher kinetic energy at 120°C than at 60°C.
 - Melting point of substance *X* is between 40°C and 75°C.

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

Column I	Column II
P. Sawdust and water	(i) Winnowing
Q. Sand and gravel	(ii) Filtration
R. Rice and husk	(iii) Separating funnel
S. Mustard oil and water	(iv) Sieving

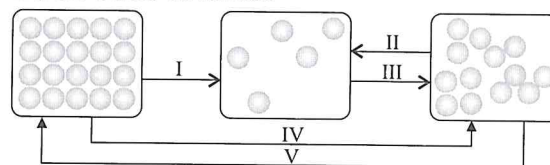
- P-(iv), Q-(ii), R-(i), S-(iii)
- P-(ii), Q-(iv), R-(iii), S-(i)
- P-(iii), Q-(ii), R-(i), S-(iv)
- P-(ii), Q-(iv), R-(i), S-(iii)

27. Properties of three substances *X*, *Y* and *Z* are given in the table.

Substance	Soluble in water	Attracted by magnet
<i>X</i>	✓	✗
<i>Y</i>	✗	✓
<i>Z</i>	✗	✗

Which of the following sequence of steps should be carried out to separate *X* from a mixture of *X*, *Y* and *Z*?

- Filtration, magnetic separation, addition of water and evaporation
 - Magnetic separation, evaporation, filtration and addition of water
 - Evaporation, magnetic separation, filtration and addition of water
 - Magnetic separation, addition of water, filtration and evaporation
28. The given figure represents the interconversion of different states of matter.



Which of the following statements are incorrect regarding the processes I, II, III, IV and V?

- Naphthalene balls kept in clothes undergo process I.
- Process V involves absorption of energy.

- (iii) Water undergoes the process II at 100°C.
 (iv) Dry ice is formed from carbon dioxide gas by the process V.
 (v) Processes I, III and IV are irreversible.
- A. (i), (iii) and (v) only
 B. (ii), (iv) and (v) only
 C. (iii) and (iv) only
 D. (i), (iii) and (iv) only

29. Rate of evaporation

- I. Increases with increase in temperature
 II. Increases with increase in humidity
 III. Decreases with increase in surface area
 IV. Decreases with decrease in wind speed
 V. Remains same irrespective of the weather conditions.
- A. I, II and IV only B. III and IV only
 C. V only D. I and IV only

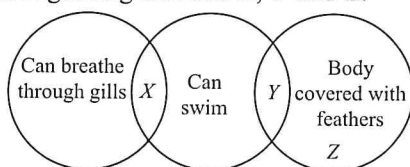
30. Study the items listed in the given table.

Group I	Group II
Plastic container	Bird droppings
Aluminium can	Rotten vegetable
X	Y
Metal vase	Fruit pulp

What can be placed at X and Y, respectively?

- | | | |
|----|----------------|--------------|
| | X | Y |
| A. | Sewage | Glass bottle |
| B. | Steel spoon | Tea leaves |
| C. | Cereals | Sandpaper |
| D. | Animal excreta | Cotton swab |
31. Read the given statements (i) - (v) and select the option that correctly identifies true (T) and false (F) ones.
- (i) Lactose is a type of sugar found in milk.
 (ii) At room temperature, saturated fats are solids whereas unsaturated fats are liquids.
 (iii) Fat soluble vitamins are not stored in our body and need to be regularly supplied through food.
 (iv) Vitamin C is very sensitive to heat and is easily destroyed during cooking.
 (v) Iodine is needed for transmission of messages by the nervous system in human body.
- | | | | | | |
|----|------------|-------------|--------------|-------------|------------|
| | (i) | (ii) | (iii) | (iv) | (v) |
| A. | T | F | F | T | T |
| B. | T | T | F | T | F |
| C. | F | T | F | F | T |
| D. | F | F | F | T | T |

32. Refer to the given Venn diagram and select the correct option regarding animals X, Y and Z.



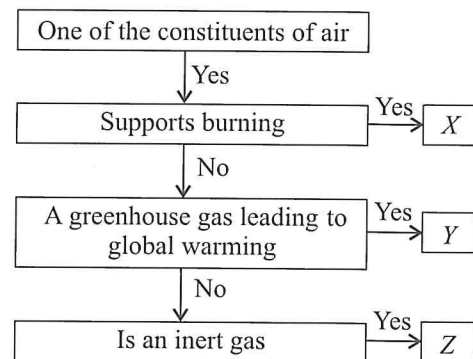
- A. X could be an animal that has scales on its body and Z could be an animal that breathes through spiracles.
 B. X could be armadillo, Y could be penguin whereas Z could be Arctic fox.
 C. X could be an animal with aquatic adaptations whereas Z could be an animal with aerial adaptations.
 D. X could be dolphin whereas Y could be kiwi.

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

Statement 1 : Cotton grows best in cold and dry climate as in Himachal Pradesh and Jammu.

Statement 2 : Harvesting of cotton is done before the maturation of flowers.

- 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.
34. Refer to the given flow chart and identify X, Y and Z.



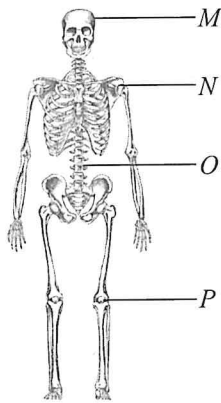
- | | | | |
|----|-----------------|-----------------|-----------------|
| | X | Y | Z |
| A. | O ₂ | CO ₂ | He |
| B. | CO ₂ | O ₂ | N ₂ |
| C. | N ₂ | CO ₂ | O ₂ |
| D. | O ₂ | He | CO ₂ |

35. The given table shows some characteristics of herbs, shrubs and trees. Which of the given points is/are incorrect?

	Feature	Herbs	Shrubs	Trees
(i)	Size	Very small, usually less than 1 m high	Medium sized, usually 1-3 m high	Tall, generally more than 3 m high
(ii)	Nature of stem	Green and tender stem with few branches	Hard and very thick stem with branches on the upper part of the stem	Hard stem but not very thick; branches arise near the base of the stem
(iii)	Examples	Grass, tomato, wheat	<i>Hibiscus</i> , rose, jasmine	Gulmohar, neem, peepal

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

36. Identify the joints labelled as *M*, *N*, *O* and *P* in the given figure and select the correct option regarding them.



	Immovable joint	Ball and socket joint	Hinge joint	Slightly movable joint
A.	<i>M</i>	<i>P</i>	<i>N</i>	<i>O</i>
B.	<i>O</i>	<i>N</i>	<i>P</i>	<i>M</i>
C.	<i>M</i>	<i>N</i>	<i>P</i>	<i>O</i>
D.	<i>O</i>	<i>P</i>	<i>N</i>	<i>M</i>

37. Match column I (nutrient) with column II (function) and column III (deficiency symptom) and select the correct option from the given codes.

	Column I	Column II	Column III
P.	Vitamin D	(i) For strong bones	(a) Anaemia
Q.	Vitamin A	(ii) Maintains normal vision	(b) Scurvy
R.	Iron	(iii) For healthy teeth and gums	(c) Rickets
S.	Vitamin C	(iv) Required for haemoglobin formation	(d) Night blindness

- A. P - (iii) - (b); Q - (i) - (c); R - (iv) - (a); S - (ii) - (d)
 B. P - (i) - (c); Q - (ii) - (d); R - (iv) - (a); S - (iii) - (b)
 C. P - (iv) - (a); Q - (ii) - (c); R - (i) - (b); S - (iii) - (d)
 D. P - (i) - (b); Q - (iv) - (a); R - (iii) - (c); S - (ii) - (d)

38. Select the incorrect statements.

- (i) The points under the ground, where the earthquake begins is called focus.
 (ii) Mt. Etna is a dormant volcano.
 (iii) Earthquake is measured on the Vernier scale.
 (iv) Subsequent tremors that follow massive earthquakes are called aftershocks.
- A. (i) and (ii) only B. (ii) and (iv) only
 C. (ii) and (iii) only D. (i) and (iv) only

39. Select the option that correctly fill the blanks in the given sentences (i)-(v).

- (a) (i) of the hemp plant provides fibres.
 (b) Knitting is done by using (ii) yarn(s).
 (c) The process of rotting of jute stems by soaking them in water is called (iii).
 (d) (iv) is obtained from the outer covering of coconut fruit.
 (e) (v) burns with a smell of burning paper.
- | | (i) | (ii) | (iii) | (iv) | (v) |
|----|------|------|---------|--------|--------|
| A. | Leaf | Two | Ginning | Coir | Silk |
| B. | Stem | One | Retting | Coir | Cotton |
| C. | Seed | One | Retting | Cotton | Coir |
| D. | Stem | Two | Ginning | Fur | Cotton |

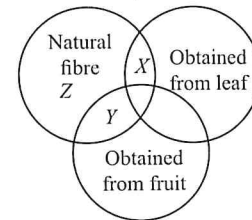
40. Given below are some adaptations shown by animals.

- (i) Padded feet
 (ii) Thick fur on the body
 (iii) Can drink large quantities of water at a time
 (iv) Nostrils with flaps
 (v) Aestivation
 (vi) Long eyelashes

Which of these adaptations are not found in polar bear?

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

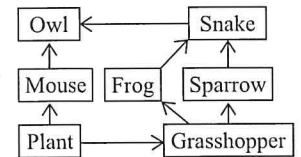
41. Study the given Venn diagram and select the option that correctly identifies *X*, *Y* and *Z*.



	<i>X</i>	<i>Y</i>	<i>Z</i>
A.	Kapok	Coir	Wool
B.	Sisal	Cotton	Silk
C.	Linen	Kapok	Flax
D.	Acrylic	Jute	Rayon

42. Refer to the given food web.

If frog and sparrow are removed from the given food web, then which of the following statements is incorrect regarding it?



- A. The population of grasshopper will increase with time.
 B. The population of snake will decline with time.
 C. Population of owl will increase with time.
 D. Population of plants will decrease comparatively.

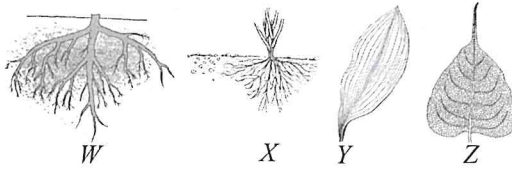
43. Refer to the given relationship.

Gold : Petroleum : Ruby

Select the option which correctly satisfies the same relationship.

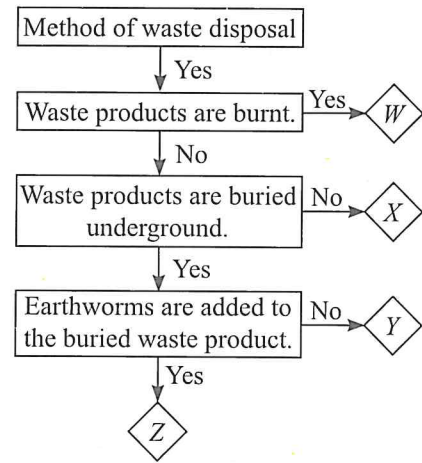
- A. Copper : Pumice : Diamond
- B. Platinum : Gneiss : Shale
- C. Silver : Coal : Emerald
- D. Aluminium : Talc : Granite

44. Refer to the given figures and select the incorrect statement regarding them.



- A. Mango and *Hibiscus* plants have *W* type of roots and *Y* type of leaves.
- B. Banana and palm plants have *Y* type of leaves.
- C. Wheat and maize plants have *X* type of roots.
- D. Neem and rose plants have *Z* type of leaves.

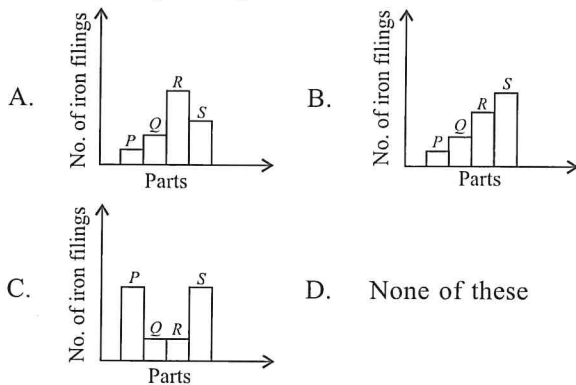
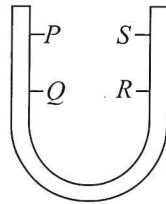
45. The given flow chart represents various methods of waste disposal. Identify *W*, *X*, *Y* and *Z* and select the incorrect option regarding them.



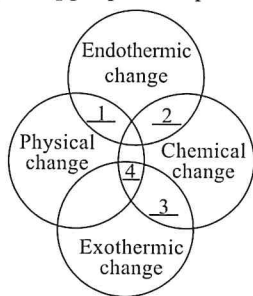
- A. Medical wastes can be disposed of by process *W*.
- B. Process *X* can be land filling which is used for liquid waste disposal.
- C. Manure can be produced by process *Y*.
- D. Biodegradable kitchen waste can be disposed of by process *Z*.

ACHIEVERS SECTION

46. Neha is doing an experiment to find the strength of various parts of a U-shaped magnet. She spreads some iron filings on a sheet of paper and brings the magnet near the sheet. Which of the following bar graphs correctly represents the number of iron filings stuck to various parts of the U-shaped magnet?

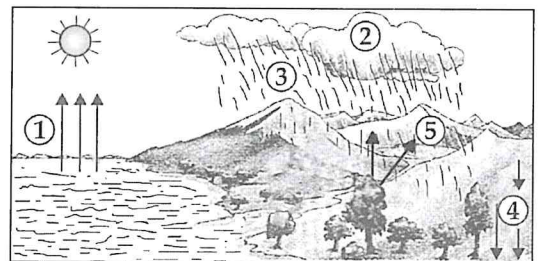


47. Study the given Venn diagram and fill in the blanks by selecting an appropriate option.



	1	2	3	4
A. Condensation	Cooking of food	Burning of LPG in a gas stove	Boiling of water	Burning of LPG in a gas stove
B. Freezing	Souring of milk	Dissolving common salt in water	Burning of candle	Burning of wood
C. Sublimation of dry ice	Baking of cake	Dissolving washing soda in water	Burning of candle	Burning of wood
D. Boiling of water	Tearing a paper	Dissolving glucose in water	Burning of wood	

48. Refer to the given diagram representing water cycle where different processes have been labelled as 1, 2, 3, 4 and 5.



Select the correct option regarding these.

- A. Both process 2 and process 3 will increase when humidity of air decreases.
- B. Process 4 can involve change from gaseous to liquid state or from gaseous to solid state depending upon the ambient temperature.
- C. An increase in process 1 can gradually lead to a decrease in process 2.
- D. An increase in process 5 leads to an increase in process 2.

49. Abhishek classified living organisms into four groups (I, II, III and IV) each containing four members on the basis of the habitats in which they are found. In doing so, he unknowingly placed one wrong member in each group. Identify the odd one out and select the correct option regarding this.

- I. Gorilla, Macaw, Cactus, Orchid
 - II. Kangaroo rat, Rattle snake, Date palm, Tape grass
 - III. Reindeer, Polar bear, Arctic fox, Gila monster
 - IV. *Pistia*, *Vallisneria*, Fir, *Hydrilla*
- A. In group I, cactus is placed incorrectly and should be replaced with date palm of group II.
 - B. In group II, tape grass is incorrectly mentioned and should be replaced with *Pistia* of group IV.
 - C. In group III, Gila monster is mentioned incorrectly and should be replaced with snowshoe hare.
 - D. Fir is wrongly placed in group IV and should be replaced with macaw of group I.

50. A fabric swatch was found at a crime scene. It was found to burn with a smell of charred meat. To identify the criminal from his clothings, the investigating officer took fabric samples from clothing of four suspects. He placed the collected data in the given chart to help him identify the sample taken from the crime scene.

Source of fabric	Texture	Absorbance of liquid	Type of fabric
Suspect <i>P</i>	Smooth	Low	Natural
Suspect <i>Q</i>	Rough	High	Natural
Suspect <i>R</i>	Rough	Zero	Synthetic
Suspect <i>S</i>	Smooth	Zero	Synthetic

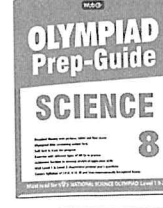
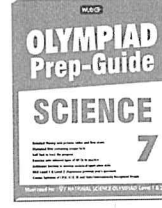
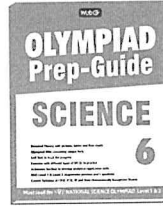
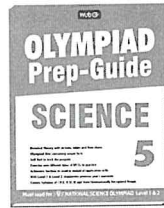
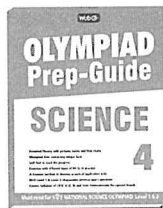
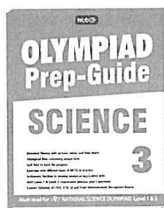
The data suggests that the most likely culprit is _____.

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

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