Techfest IIT Bombay
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SOF NATIONAL SCIENCE OLYMPIAD 2023-24

CLASS 8

QUESTION PAPER SET A

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. 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.

   16. ● Ⓑ Ⓒ Ⓓ
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 before attempting the paper.
10. ***For classes 8, 9 & 10, "Innovation Challenge" is being conducted by Techfest IIT Bombay in association with SOF. For details and to participate, please turn to last page.***

Name:.....

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SOF
SCIENCE OLYMPIAD FOUNDATION
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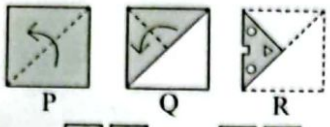
1. A set of three figures P, Q and R are showing a sequence of folding of a piece of paper. Fig. R shows the manner in which the folded paper has been cut. Select a figure from the options which represents the unfolded form of Fig. R.



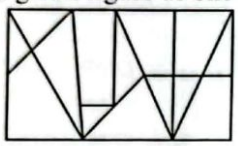
A.  B.  C.  D. 

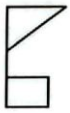
2. There is a certain relationship between the pair of terms on the either side of : :. Identify the relationship on the left pair and find the missing term.

L6T : Q18Y : : R9E : ?

A. V27J B. W28K C. V28K D. W27J

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



A.  B.  C.  D. 

4. In the given question, two rows of numbers are given. The resultant number in each row is to be worked out separately based on the following rules and the question below the rows of numbers is to be answered. The operations on numbers progress from left to right.

Rules :

(i) If an odd number is followed by an even number, then both are to be added.

(ii) If an odd number is followed by another odd number, then the first number is to be divided by the second number.

(iii) If an even number is followed by a prime number, then the prime number is to be subtracted from the even number.

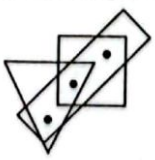
(iv) If an even number is followed by a number which is a perfect square, then both are to be multiplied.

25 5 10
22 7 3

If m is the resultant of first row and n is the resultant of second row, then the value of $m + n$ is

A. 20 B. 15 C. 10 D. 25

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



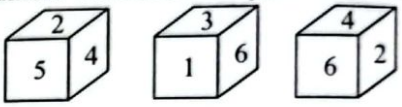
A.  B. 

C.  D. 

6. In a certain code language, TRAINER is written as PCLKDUW. How will EDITION be written in the same code language?

A. FFLTJQQ B. LMGVLGH
C. FFLTJPR D. HGLUGMV

7. Three different positions of a dice are given below. Which number will be at the top, if 3 is at the bottom?



A. 4 B. 5 C. 1 D. 2

8. A city bus travels 16 km towards West from point *A*. It then turns right and travels 6 km and then turns right again and travels 8 km. Finally, it turns right and travels 12 km to reach point *B*. How far is point *A* from point *B*?

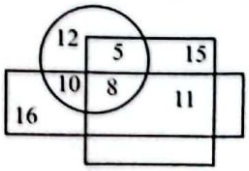
A. 9 km B. 12 km C. 10 km D. 15 km

9. Select the correct water image of the given figure.

A.  B. 

C.  D. 

10. In the given Venn diagram, rectangle represents people who like travelling, square represents people who have visited a hill station and circle represents people who have visited a desert. Which of the following numbers represents people who like travelling and have visited a hill station but not desert?



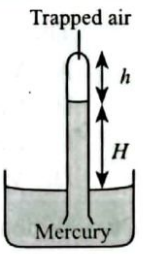
A. 10 B. 5 C. 8 D. 11

11. Given below are the actions in the form of push or pull and the effect of the force for each action is given. Select the option which correctly identifies them as true (T) and false (F) ones.

	Action	Pull	Push	Effect of force
(i)	Squeezing a sponge	✓	–	Changes the shape of the sponge
(ii)	Lifting the lid of a box	✓	–	Moves the lid to a different location
(iii)	Pedalling a bicycle	–	✓	Moves the bicycle forward
(iv)	Flicking away a beetle crawling towards you	✓	–	Changes the direction of the beetle

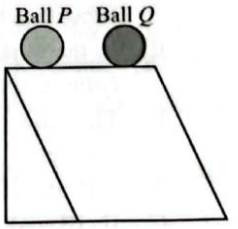
	(i)	(ii)	(iii)	(iv)
A.	F	F	T	T
B.	F	T	T	F
C.	T	T	F	F
D.	T	F	F	T

12. The given figure shows a mercury barometer that contains a trapped air column. What happens to h and H when the barometer tube is kept pushed deeper into the mercury?



	h	H
A.	It remains constant	It decreases
B.	It decreases	It decreases
C.	It decreases	It increases
D.	It remains constant	It remains constant

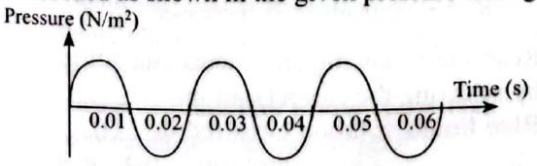
13. Two balls of the same mass and size but different surface textures were released from the top of a wooden ramp as shown in the given figure. Ball Q moved a lesser distance along the ground than ball P. What can be concluded about the surface texture of the two balls?



(i) The surface of ball Q is smoother than the surface of ball P.
(ii) The surface of ball P is smoother than the surface of ball Q.
(iii) The surface of both the balls is equally smooth.
(iv) A smoother surface experiences lesser friction.

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

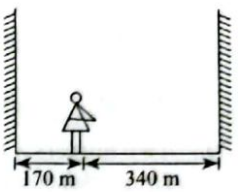
14. The pressure variation of the air around a vibrating string is recorded as shown in the given pressure-time graph.



If the speed of sound in air is 320 m/s, then the wavelength of sound produced by the vibrating string is

A. 6.4 m B. 4.2 m C. 3.5 m D. 2.0 m

15. A student stands between two walls and claps his hands once as shown in the given figure. Now, match column I with column II and select the correct option from the given codes. (Speed of sound is 340 m/s)



	Column I	Column II
P.	The first echo heard after	(i) 1 s
Q.	The second echo heard after	(ii) 2 s
R.	Time interval between the two echoes	(iii) 2.5 s

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

16. A tester is used to check the conduction of electricity through two liquids labelled as X and Y. It is found that the bulb of the tester glows brightly for liquid X while it glows very dim for liquid Y. Which one of the following options is correct for the given process?

A. Liquid Y is better conductor than liquid X.
B. Liquid X is better conductor than liquid Y.
C. Both liquids are equally conducting.
D. Conducting properties of liquid cannot be compared.

17. Two identical metal spheres P and Q are placed in contact with each other and are supported on insulating stands. When a negatively charged ebonite rod is brought near P, what kind of charges will develop on P and Q?

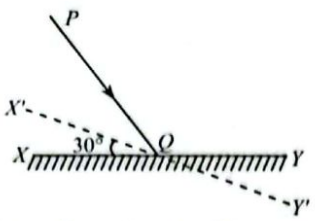
	P	Q
A.	Positive	Negative
B.	Negative	Positive
C.	Negative	Negative
D.	Positive	Positive

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

	Column I	Column II
P.	Loss of electrons by a body leads to	(i) Electroscope
Q.	Material having large number of free electrons	(ii) Electric current
R.	Flow of charge	(iii) Positive electrification
S.	Device used for detecting static electric charge	(iv) Conductor

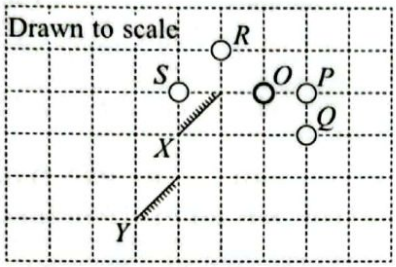
A. P-(i), Q-(iii), R-(ii), S-(iv)
B. P-(iii), Q-(iv), R-(ii), S-(i)
C. P-(ii), Q-(iii), R-(iv), S-(i)
D. P-(iii), Q-(iv), R-(i), S-(ii)

19. A ray of light PQ is incident on a plane mirror XY as shown in the given figure. If the mirror is turned through 30° to position $X'Y'$ (without changing the direction of ray PQ), then the angle through which the reflected ray will rotate is



A. 60° B. 50° C. 40° D. 45°

20. Two mirrors X and Y (facing each other) and an object O are placed in the grid as shown in the given figure. At which position(s) can virtual image of object O be formed?



A. R only B. S only
C. P and Q only D. Q and R only

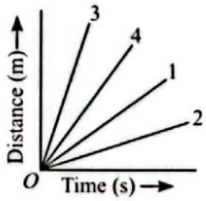
21. Read the given statements and select the correct option.

Statement 1 : The temperature of a body is 10°C. Its temperature in Fahrenheit scale is 50°F.

Statement 2 : Celsius and Fahrenheit are related as $F = \frac{9}{5}C + 32$.

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.

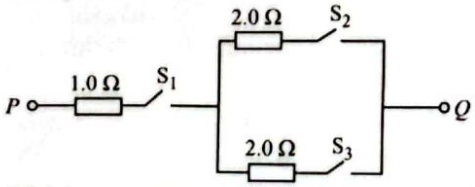
22. Four cars 1, 2, 3 and 4 are moving on a levelled road. Their distance versus time graphs are shown in the given figure. Which of the following statement(s) is/are correct?



(i) Car 2 is the slowest.
(ii) Car 1 is faster than car 4.
(iii) Car 3 is faster than car 4.

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

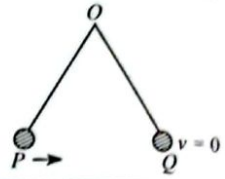
23. The given figure shows a circuit in which all the switches are open.



Which one of the following switch positions will give an effective resistance of 3.0 Ω between P and Q?

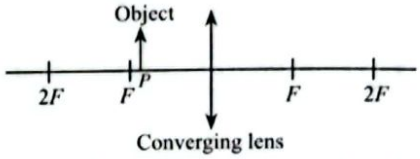
	S_1	S_2	S_3
A.	Open	Closed	Closed
B.	Open	Open	Closed
C.	Closed	Closed	Closed
D.	Closed	Closed	Open

24. The bob of a pendulum is released from point P and it comes to rest at point Q as shown in the given figure. The time taken by bob to move from point P to point Q is 0.8 second. The time taken by the same bob to make 14 oscillations is



A. 16 s
B. 22.4 s
C. 9.6 s
D. 8.0 s

25. An object is placed at the position P in front of a converging lens as shown in the given schematic diagram.



The characteristics of the image produced are

A. Virtual, Upright, Magnified
B. Real, Inverted, Diminished
C. Real, Upright, Magnified
D. Virtual, Inverted, Diminished

26. Which of the following statements are correct?

I. No residue is left on an object placed in the middle zone of the flame.
II. When there is a sufficient supply of oxygen, the substance burns completely producing a blue flame.
III. In the dark zone of the flame, wax vapours do not come in contact with oxygen, hence do not burn.
IV. The calorific value of LPG is higher than that of kerosene.

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

27. Observe the given figure and select the correct statement.

A. The given process depicts a physical change as it involves only a change in the colour of the iron nail.
B. The process becomes faster when iron nail is coated with a layer of zinc.
C. The process represents a chemical change that can be reversed by increasing the moisture content in the air.
D. The given process becomes faster when moisture in the atmosphere is increased.

28. Read the following statements and fill in the blanks by selecting the correct option.

Blue litmus solution turns red in __(i)__ .
Methyl orange indicator turns __(ii)__ in a soft drink.

China rose indicator turns ___(iii)___ in milk of magnesia solution.
Turmeric indicator turns red in ___(iv)___ .

	(i)	(ii)	(iii)	(iv)
A.	Soap solution	Yellow	Green	Tomato juice
B.	Hydrochloric acid	Red	Green	Window cleaner
C.	Nitric acid	Yellow	Magenta	Detergent solution
D.	*Amla* juice	Red	Magenta	Carbonic acid

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

	Column I		Column II
P.	Coal	(i)	Petroleum refining
Q.	Coke	(ii)	Destructive distillation of coal
R.	Bitumen	(iii)	Liquefied form of dead organic matter
S.	Crude oil	(iv)	Carbonisation
		(v)	Black gold

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

30. Select the incorrect match.
A. Does not produce flame – Charcoal
B. Incomplete combustion – Non-luminous zone of a candle flame
C. Burning of LPG gas – Rapid combustion
D. Supporter of combustion – Oxygen

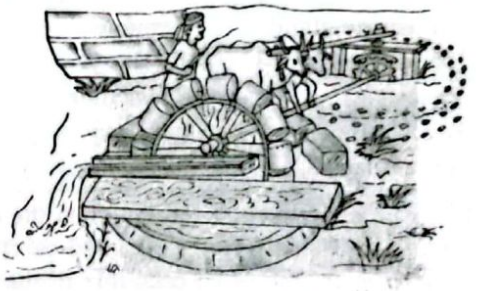
31. Read the given statements and select the option that correctly identifies them as true (T) and false (F) ones.
I. China rose indicator turns green in caustic soda and in curd.
II. Phenolphthalein remains colourless in tamarind juice and in salt solution.
III. Turmeric indicator remains yellow in lemon juice and in aerated drinks.
IV. Methyl orange indicator turns yellow in tomato juice and in sugar solution.

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

32. A brief description about four substances is given below :
W : A liquid fuel that is used in jet aircrafts.
X : A thick, black liquid from which naphthalene balls are obtained.
Y : A cleaner fuel used for power generation.
Z : A petroleum product that is used for surfacing of roads.
W, *X*, *Y* and *Z* are respectively.
A. Kerosene, Coke, Petrol, LPG
B. Kerosene, Coal tar, CNG, Bitumen
C. Petrol, Coal gas, Diesel, Coal tar
D. Diesel, Coal tar, Coke, Lubricating oil

33. Which of the following statements are incorrect?
I. The calorific value of methane is greater than that of petrol.
II. The hottest zone of the candle flame is the outermost zone.
III. Burning of phosphorus in air at room temperature is an example of rapid combustion.
IV. Water cools the combustible material so that its temperature is brought above its ignition temperature.
A. III and IV only B. I, III and IV only
C. II, III and IV only D. I and IV only

34. Identify the method of irrigation shown in the given figure and select the correct statement regarding it.



A. It is a modern method of irrigating the crop fields.
B. It is based on lever system.
C. By this method of irrigation water is delivered drop by drop at the base of each plant.
D. This modern method of irrigation is used only in areas where the soil is sandy.

35. Names of few algae are given in the box.

Laminaria, Polysiphonia, Ulothrix, Fucus, Sargassum, Chlamydomonas, Gelidium, Spirogyra

How many among them are brown algae?
A. 3 B. 2 C. 4 D. 5

36. Select the correct statement regarding organism *X* shown in the given figure.

X

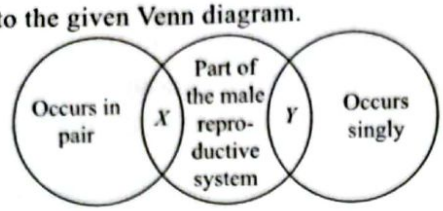
A. Organism *X* contains chlorophyll and can perform photosynthesis.
B. Outermost covering of organism *X* is called cell wall.
C. Organism *X* reproduces by budding during unfavourable conditions.
D. Organism *X* belongs to a group that is considered as a connecting link between non-living and living things.

37. Which of the following is an *ex-situ* method of conserving biodiversity?
A. Zoological park B. Wildlife sanctuary
C. National park D. Biosphere reserve

38. Percentage of carbon dioxide in exhaled air is approximately _____.

A. 21% B. 0.04% C. 4.4% D. 16.4%

39. Refer to the given Venn diagram.



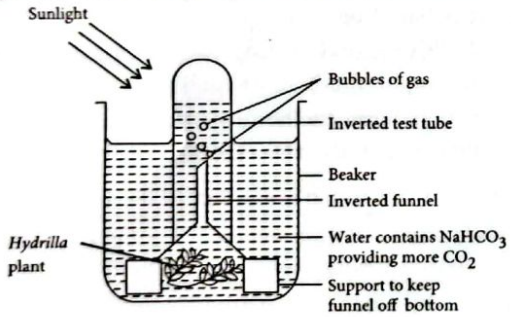
Identify X and Y and select the incorrect statement regarding them.

A. X could be an organ where sperms are produced.
B. Y could be a narrow tube that helps to transport sperms from testes to the urethra.
C. X could be an organ that produces testosterone.
D. Y could be an organ that transfers semen into the vagina of the female.

40. Which of the following is a mismatched pair?

	Endocrine gland		Hormone
A.	Pituitary	–	ACTH
B.	Testes	–	Testosterone
C.	Pancreas	–	Calcitonin
D.	Pineal gland	–	Melatonin

41. In the given experimental set-up, when the test tube containing bubbles of gas is removed carefully and glowing splinter is inserted deep into it, the glowing splinter burns brightly. It demonstrates that



A. Chlorophyll is necessary for photosynthesis
B. Oxygen is released during photosynthesis
C. Starch is formed during photosynthesis
D. Water is absorbed by plants during photosynthesis.

42. Select the incorrect statement.

A. In Garhwal region of Uttarakhand, Chipko Movement, a tree hugging movement was started to save trees from cutting down.
B. Silviculture is the practice of controlling the establishment, health and quality of forests.
C. Poaching is a major threat to wildlife.
D. An arboretum is a place that maintains the stocks of viable seeds, tissue culture and frozen germplasm.

43. Read the given statement and select the option that correctly fills the blanks in it.

In a healthy adult human being, urine consists of (i) water, (ii) urea and (iii) other waste products.

	(i)	(ii)	(iii)
A.	70%	20%	10%
B.	95%	2.5%	2.5%
C.	50%	25%	25%
D.	95%	4.5%	0.5%

44. Refer to the given list of few hormones.

(i) Progesterone (ii) Relaxin
(iii) Estrogen (iv) Inhibin

Which among the given hormones is/are secreted by ovaries?

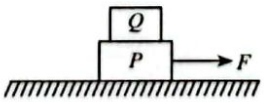
A. (i) only B. (i) and (iii) only
C. (i), (ii) and (iv) only D. (i), (ii), (iii) and (iv)

45. Select the incorrect match.

	Seed		Agent of dispersal
A.	Coconut	–	Water
B.	*Urena*	–	Animal
C.	Madar	–	Wind
D.	*Hiptage*	–	Animal

ACHIEVERS SECTION

46. Consider a system of two blocks P and Q. These blocks are placed such that one is on top of the another on a horizontal surface. A force F is applied on the lower block P as shown in the given figure.



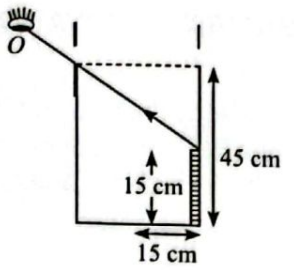
Unless otherwise mentioned about friction between P and Q, between P and the horizontal surface, assume smooth surfaces. Now, consider the following statements.

I. The blocks will move together initially, and then gets separated.
II. If there is friction between surfaces of P and Q, and the horizontal surface is smooth, then there is a maximum value of F up to which both the blocks will move together.
III. In the case II, if masses of P and Q are interchanged, then the maximum value of F for the combined motion of P and Q will change.
IV. In the case II, if force F is applied on Q, then the maximum value of F for the combined motion will change.

Select the correct statements.

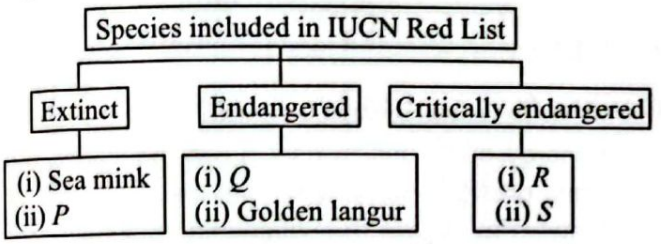
A. I and II only B. II and III only
C. III and IV only D. II and IV only

47. The observer O can see through a small orifice on the side of a container (radius 15 cm) at a point situated at a height of 15 cm from the bottom as shown in the given figure. The orifice is at height of 45 cm. When the container is filled with a liquid up to a height of 30 cm, the same observer can see the bottom of the container. If the refractive index of liquid is $x/50$, where x is an integer, then the value of x is



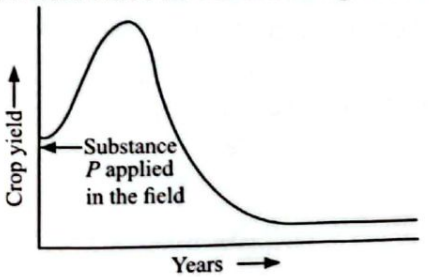
A. 79 B. 75 C. 86 D. 158

48. Refer to the given classification chart and select the option that correctly identifies *P-S*.



	P	*Q*	*R*	*S*
A.	Passenger pigeon	Lion-tailed macaque	Bornean orangutan	Eastern black rhino
B.	Greater one-horned rhino	Hawaiian crow	Dodo	Blue whale
C.	Giant panda	Ivory-billed woodpecker	Leatherback turtle	Snow leopard
D.	Alagoas curassow	Snow leopard	Nilgiri langur	Asian elephant

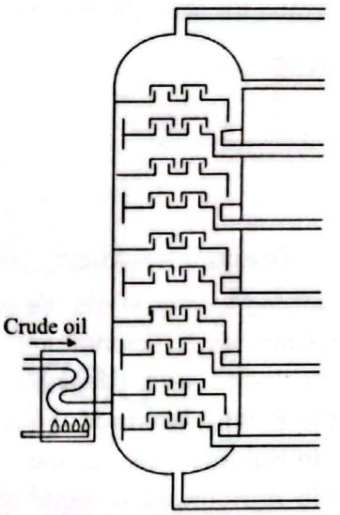
49. Raghu uses a substance P in his field to increase the crop yield. The given graph shows the crop production of Raghu's field since he started using substance P.



Identify the substance P and select the incorrect statement regarding it.

A. P does not contain humus.
B. P is readily absorbed by the plants.
C. P is not nutrient specific and removes only general deficiency of the soil.
D. P is water soluble and is prepared in factories.

50. Read the given figure carefully and fill in the blanks by selecting the correct option.



The process shown in the given figure is called fractional distillation. The difference in the __(i)__ of various components of petroleum is used to separate them. The fraction __(ii)__ will be condensed before fraction __(iii)__ as it has __(iv)__ .

	(i)	(ii)	(iii)	(iv)
A.	Boiling point	Diesel	Kerosene	Higher boiling point
B.	Boiling point	Gasoline	Heavy oil	Lower boiling point
C.	Density	Petroleum gas	Naphtha	Higher density
D.	Melting point	Kerosene	Diesel	Lower melting point

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FOR CLASSES 8, 9 & 10

SOF-TECHFEST IIT BOMBAY INNOVATION CHALLENGE

About the Challenge:

Techfest is Asia's Largest Science and Technology Festival and the Annual Science and Technology Festival of IIT Bombay. Techfest IIT Bombay is conducting Innovation Challenge in association with Science Olympiad Foundation for school students across the globe.

Guidelines:

- Appearing in the Innovation Challenge is not compulsory. No registration fee is to be paid.
- To participate, read the following problem statement and email the answer at ic.iitbombay@sofworld.org.
- Answers should be submitted as per the following schedule:

NSO Set-A 17th October	NSO Set-B 21st November	NSO Set-C 5th December
By 22nd October	By 26th November	By 10th December

PROBLEM STATEMENT

Green Innovation : Technological Breakthroughs for a Sustainable Tomorrow

In a rapidly evolving world, where the demand for resources and energy continues to rise, green innovation offers a pathway to mitigate environmental impact while promoting economic growth and societal well-being. Some of how innovative technologies are reshaping industries, practices, and lifestyles to align with sustainable principles are:

- **Sustainable Plastic Waste Management** - Without affecting the usage of plastic
- **Sustainable Habitat** - Zero or low energy consumption, low embodied energy and low construction waste
- **Sustainable Agriculture** - Focus on soil degradation, excessive water usage, detrimental effects of pesticides, insecticides, and fertilisers

Choose ANY ONE of the above topics and answer in the following format :

Title - Write the title of the chosen topic.

Problems - Describe the social, industrial, and environmental challenges corresponding to the topic and need for sustainable solutions (in about 100-150 words).

Solutions - Innovate and explain the sustainable solutions to the problems stated above (in about 150-200 words).

Conclusion - Justify your solutions concerning their implementation and impact (in about 50-100 words).

Rewards:

- Each participant will be awarded a Certificate of Participation from SOF-Techfest, IIT Bombay.
- Top 20 students will be invited to Techfest 2023-24 with an accompanying adult from 27th to 29th December 2023 with travel and accommodation provided by Techfest, IIT Bombay.
- Winners will be awarded trophies, gifts, merit certificates, and a visit to ISRO's Vikram Sarabhai Space Centre, Thiruvananthapuram with expenses reimbursed.

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