SCIENCE OLYMPIAD FOUNDATION

Inspiring Young Minds
Through Knowledge Olympiads

CLASS 9

SET-B

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Name:.....

Section:.....Roll No.:.....

Contact No.....

Total Questions: 50 Time: 1 hr.

19TH SOF NATIONAL SCIENCE OLYMPIAD

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 **% of marks/grade** in last class clearly on the **OMR Sheet** and do not forget to sign it.
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 in 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 in the OMR Sheet.

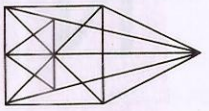
16. ● Ⓑ Ⓒ Ⓓ

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 space on top of this page before attempting the paper.

1. Trishika and Sidak started walking from two different points 'A' and 'B' respectively. Trishika walks 5 km North and turns to the East and walks 6 km. She again turns to North and walks 4 km and finally she turns to East and walks 3 km to reach point 'C'. Similarly, Sidak walks 5 km North and turns to West and walks 6 km and finally turns to North, walks 4 km and meets Trishika at point 'C'. In which direction is point 'B' from point 'A'?

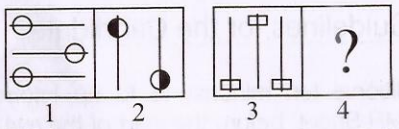
A. East B. West
C. South D. North

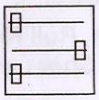
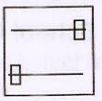
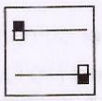
2. Count the number of triangles formed in the given figure.



A. 36
B. 32
C. 38
D. None of these

3. There is a definite relationship between figures 1 and 2. Establish a similar relationship between figures 3 and 4 by selecting a suitable figure from the given options that would replace the (?) in fig. 4.

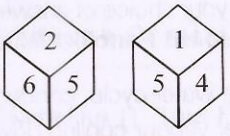


A. 
B. 
C. 
D. 

4. If in a certain code language, LATE is coded as 8&4$ and HIRE is coded as 7★3$, then how will HAIL be coded in the same language?

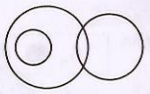
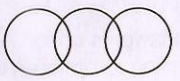
A. 7&8★ B. &7★8
C. 7★&8 D. 7&★8

5. Two positions of a dice are shown here. Find the number opposite to 3.

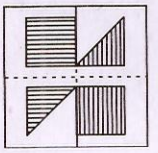


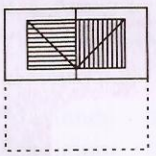
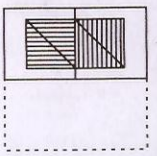
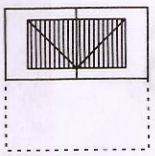
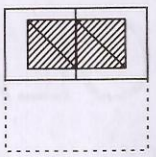
A. 2
B. 4
C. 5
D. 6

6. Which of the following Venn diagrams best represents the relationship amongst, "Males, Females and Brothers"?

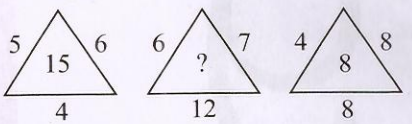
A. 
B. 
C. 
D. 

7. A square transparent sheet with a pattern on it is given. If the sheet is folded along the dotted line, then which pattern would appear from the given options?



A. 
B. 
C. 
D. 

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



A. 4 B. 12
C. 7 D. 14

9. A word and number arrangement machine when given an input line of words and numbers, rearranges them following a particular rule in each step. The following is an illustration of input and steps of rearrangement.

Input : wind packet 19 7 back 12 task 34

Step I : 34 wind packet 19 7 back 12 task

Step II : 34 back wind packet 19 7 12 task

Step III : 34 back 19 wind packet 7 12 task

Step IV : 34 back 19 packet wind 7 12 task

Step V : 34 back 19 packet 12 wind 7 task

Step VI : 34 back 19 packet 12 task wind 7

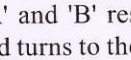
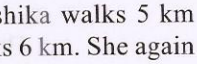
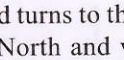
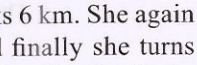
Step VII : 34 back 19 packet 12 task 7 wind and Step VII is the last step.

As per the rules followed in the above steps, if Step II of an input is "37 desk 34 garden 5 father victory 17", then which of the following steps will be the last step?

A. Step III B. Step V
C. Step IV D. Step VI

10. Select the correct water image of the given combination of letters and numbers from the given options.

LosCi2016nSo

A. 
B. 
C. 
D. 

11. A particle starts from rest and travels a distance x with uniform acceleration, then it travels a distance $2x$ with uniform speed, finally it travels a distance $3x$ with uniform retardation and comes to rest. If the whole motion of the particle is a straight line, then the ratio of its average velocity to maximum velocity is

A. 6 : 7 B. 4 : 5
C. 2 : 3 D. 3 : 5

12. A student uses a spring balance of range 500 g wt. He records the weight of a small iron cube of mass 100 g in air, in tap water and in a concentrated solution of common salt in water. His three readings taken in the given order are W_1, W_2 and W_3. His measurements could be

A. $W_1 = W_2 = W_3$ B. $W_1 > W_2 > W_3$
C. $W_1 < W_2 < W_3$ D. $W_1 < W_2 > W_3$

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

Statement 1 : A spaceship, while entering the Earth's atmosphere is likely to catch fire.

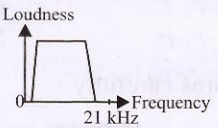
Statement 2 : The temperature of the upper atmosphere is very high.

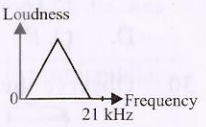
A. Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
B. Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
C. Statement 1 is true but statement 2 is false.
D. Both statements 1 and 2 are false.

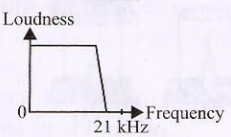
14. Two particles, one with constant velocity of 50 m s^{-1} and the other start from rest with uniform acceleration of 10 m s^{-2}, start moving simultaneously from the same position in the same direction. They will be at a distance of 125 m from each other after

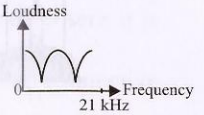
A. 5 s and $5(1+\sqrt{2})$ s
B. 5 s and 10 s
C. $5(1+\sqrt{2})$ s and 10 s
D. 10 s and $10(1+\sqrt{2})$ s.

15. A signal generator is connected to a loud speaker. Keeping the amplitude of the wave constant, the frequency of the sound is increased from 0 Hz to 21 kHz. Which of the following graphs shows the variation of the loudness of the sound with the frequency as heard by a normal healthy man?

A.


B.


C.


D.


16. A body is projected vertically up. At certain height h above the ground, the ratio of its potential energy to the kinetic energy is 2 : 3. At what height above the ground, the ratio of its kinetic energy to the potential energy will be 2 : 3 ?

A. $\frac{2}{5}h$ B. $\frac{3}{2}h$
C. $\frac{4}{7}h$ D. $\frac{9}{8}h$

17. In an experiment to measure the speed of sound in air, a boy stands 40 m from a wall and bangs two pieces of wood together. At the instant he hears the echo, he bangs them together again. He does this activity 50 times. The time taken for 50 bangs is 12 s. Which calculation gives the speed (in m s^{-1}) of sound in air?

A. $\frac{10}{40\times 50}$ B. $\frac{40\times 50}{12}$
C. $\frac{40\times 2\times 50}{12}$ D. $\frac{40\times 2\times 12}{50}$

18. Two vessels P and Q of equal volume and weight are immersed in water to depth h. The vessel P has an opening at the bottom through which water can enter. If the work done in immersing P and Q are W_P and W_Q respectively, then

A. $W_P > W_Q$
B. $W_P < W_Q$
C. $W_P = W_Q$
D. Cannot be predicted.

19. The density of a planet PL1 is thrice that of planet PL2. The acceleration due to gravity at the surface of PL1 is $\frac{1^{th}}{9}$ of that at the surface of planet PL2. If the radius of planet PL2 is R, then the radius of planet PL1 will be

A. $R/3$ B. $R/27$
C. $27R$ D. $81R$

20. A ball of mass 400 g is dropped from a height of 5 m. A boy on the ground hits the ball vertically upwards with a bat with an average force of 100 N, so that it attains a vertical height of 20 m. The time for which the ball remains in contact with the bat is (Take g = 10 m s^{-2})

A. 0.08 s B. 0.12 s
C. 2 s D. 5 s

21. Which of the following statements does explain how a positively charged object becomes neutral when someone touches it?

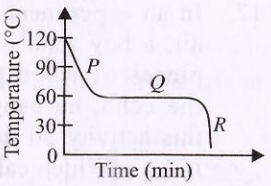
A. Electrons flow from the object.
B. Electrons flow on to the object.
C. Protons flow from the object.
D. Protons flow on to the object.

22. Which of the following statements are incorrect?

(i) Pupil gives the eye its distinctive colour.
(ii) Iris controls the amount of light entering into the eye.
(iii) Cones are sensitive to dim light and rods to bright light.
(iv) Near point for a normal eye is 25 m.
(v) Far point for a normal eye is infinity.

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

23. Dhairya, a Class 9 student heated a solid '*X*' beyond its melting point. Then, he allowed the hot liquid to cool slowly and recorded the temperature at regular time intervals until it cooled to 20°C. He obtained the given cooling curve.



The parts of graph where '*X*' exists in solid state, in liquid state and in both solid and liquid states are respectively

A. *Q*, *P* and *R*
B. *P*, *Q* and *R*
C. *R*, *P* and *Q*
D. *R*, *Q* and *P*.

24. Fill in the blanks by choosing an appropriate option.

W is a very reactive metal, reacts vigorously with oxygen and water therefore, stored in (1).

X is a non-metal, soft and dull and forms (2) oxides with oxygen.

Y is very reactive (3), catches fire if exposed to air therefore, stored in water.

Z does not react with dilute hydrochloric acid even on heating but it reacts with sulphuric acid. When it is exposed to moist air for long, it acquires a dull (4) coating.

A. *W*-Na, 1-Water; *X*-S, 2-Basic; *Y*-P, 3-Metal; *Z*-Cu, 4-Reddish brown
B. *W*-Mg, 1-Kerosene; *X*-P, 2-Acidic; *Y*-Si, 3-Metal; *Z*-Ag, 4-Reddish brown
C. *W*-Na, 1-Kerosene; *X*-S, 2-Acidic; *Y*-P, 3-Non-metal; *Z*-Cu, 4-Green
D. *W*-Al, 1-Water; *X*-Zn, 2-Amphoteric; *Y*-P, 3-Non-metal; *Z*-Cu, 4-Green

25. Compounds formed by four different elements *P*, *Q*, *R* and *S* are PQ_3, P_2S_3, RS_2 and RQ_4.

The possible electronic configurations of elements *P*, *Q*, *R* and *S* are

	P	*Q*	*R*	*S*
A.	2, 8, 2	2, 8	2, 1	2, 8, 3
B.	2, 8, 3	2, 8	2, 1	2, 8, 2
C.	2, 8	2, 8, 2	2, 8, 3	2, 1
D.	2, 8, 3	2, 8, 7	2, 8, 4	2, 6

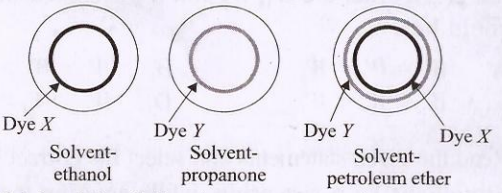
26. Read the given statements and select the correct option.

Statement 1 : During fractional distillation of petroleum, the temperature increases inside the fractionating column on going from bottom to the top.

Statement 2 : The fraction with the lower boiling point condenses first.

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.

27. A group of class 9 students was given a paint fragment containing two dyes *X* and *Y*. Three different types of chromatograms were obtained using three different solvents as shown in the figure :



Which of the following statements is correct?

A. *Y* is soluble in ethanol but X is not.
B. *X* is soluble in ethanol as well as in petroleum ether.
C. *Y* is insoluble in propanone as well as in petroleum ether.
D. All of these

28. Cotton is used to make clothes as

A. It is strong, heavy and absorbs water
B. It has low tensile strength, absorbs dyes and is transparent
C. It is light, soft, absorbs dyes and sweat
D. It is good conductor of heat.

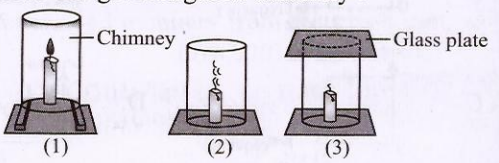
29. The composition of five particles *P*, *Q*, *R*, *S* and *T* is given in the table :

Substance	No. of protons	No. of neutrons	No. of electrons
P	25	30	25
Q	13	13	13
R	13	14	10
S	9	10	9
T	9	10	10

Identify atoms, ions and isotopes.

	Atoms	Ions	Isotopes
A.	*P*, *Q*, *S*	*R*, *T*	*S* and *T*
B.	*R*, *T*	*P*, *Q*, *S*	*Q* and *R*
C.	*P*, *Q*, *S*	*R*, *T*	*Q* and *R*
D.	*Q*, *R*	*P*, *T*	*S* and *T*

30. Observe the given figures carefully :



Which of the following statements is/are incorrect?

I. Candle 1 burns freely due to presence of air.

II. Smoke is produced in candle 2 due to less supply of air.

III. Flame finally goes off in candle 3 as air is not available.

A. II only
B. I and II only
C. I and III only
D. None of these

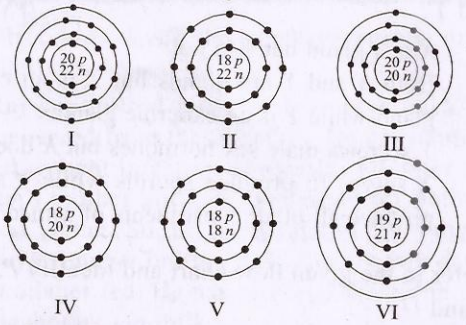
31. Match the columns I, II and III and select the correct option using the given codes.

Column I		Column II		Column III	
(a)	4.25 g of NH_3	(i)	2 moles	(p)	5.6 L at STP
(b)	4 g of H_2	(ii)	0.25 mol	(q)	$6.022 \times 10^{23} \times 0.75$ atoms
(c)	10 moles of H_2SO_4	(iii)	6.022×10^{23} atoms	(r)	14 g
(d)	12 g of oxygen gas	(iv)	0.375 mole	(s)	12.046×10^{23} molecules
(e)	1 mole of nitrogen atom	(v)	980 g	(t)	$7 \times 10 \times 6.022 \times 10^{23}$ atoms

(Given : Atomic mass of N = 14 u, H = 1 u, S = 32 u, O = 16 u)

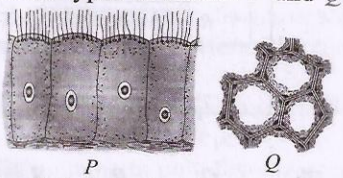
	a	b	c	d	e
A.	(iii), (q)	(i), (p)	(iv), (r)	(ii), (s)	(v), (t)
B.	(ii), (t)	(iii), (p)	(iv), (s)	(i), (q)	(v), (r)
C.	(i), (p)	(ii), (q)	(v), (r)	(iii), (s)	(iv), (t)
D.	(ii), (p)	(i), (s)	(v), (t)	(iv), (q)	(iii), (r)

32. Which of the following are isobars?



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

33. Shown below are the diagrammatic representations of two different types of tissues *P* and *Q*.



Which of the following holds true regarding tissues *P* and *Q*?

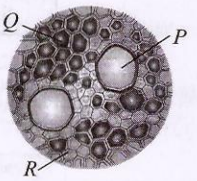
A. Tissue *P* helps in gaseous exchange in multicellular animals.

B. Tissue *Q* provides mechanical support, elasticity and tensile strength to the plant part where it is present.

C. Tissue *P* is the most widely distributed connective tissue in animal body.

D. Cells of tissue *Q* have extremely thick walls, which possess thickenings of pectin and lignin at corners.

34. Refer to the given cross-section of conducting tissue of a plant and select the correct option regarding *P*, *Q* and *R*.



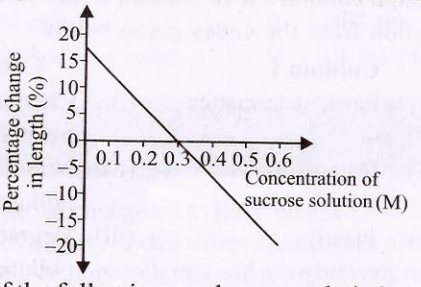
A. *P* and *R* are non-living cells devoid of living protoplast at maturity.

B. *P* is present in all vascular plants whereas *Q* is confined to angiosperms only.

C. Both *P* and *Q* take part in conduction of water but *P* possesses perforations whereas *Q* is imperforated cell.

D. None of these

35. Potato tuber strips measuring 5 cm were prepared and placed in Petri dishes filled with varying concentrations of sucrose solution (0.0M to 0.6M). After 20 minutes, their final lengths were recorded and their percentage change in length calculated. The graph below shows the percentage change in length of potato strips in increasing concentrations of sucrose solution.



Which of the following can be correctly inferred from the given graph?

A. 0.3 M sucrose solution is isotonic to cell sap of potato cells.

B. Negative percentage change in potato strip length is due to endosmosis.

C. Positive percentage change in potato strip length is due to exosmosis.

D. 0.6 M sucrose solution is hypotonic and 0.2 M sucrose solution is hypertonic to cell sap of potato cells.

36. Shown below are cross sectional diagrams of three animals *P*, *Q* and *R*.

Which of the following is correct regarding organisms *P*, *Q* and *R*?

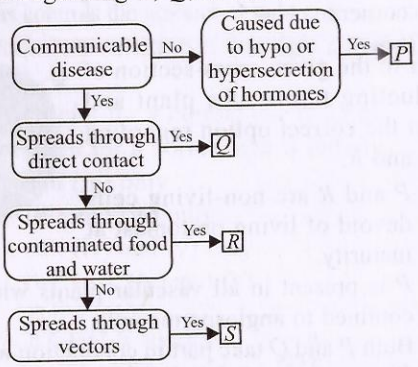
A. Organism *P* is always diploblastic whereas organisms *Q* and *R* are triploblastic.

B. Organism *Q* could be a flatworm or a round-worm.

C. Body cavity of organism *Q* arises from embryonic mesoderm.

D. Organism *R* could be an annelid or an echinoderm.

37. Refer to the given flow chart and select the correct option regarding *P*, *Q*, *R* and *S*.



A. Disease *P* is caused due to malfunctioning of exocrine glands while diseases *Q*, *R* and *S* are caused by pathogenic microbes.
B. *S* is a contagious disease while *Q* and *R* are non contagious diseases.
C. *Q* could be hepatitis *B* while *R* could be Kala azar.
D. *S* could be sleeping sickness while *R* could be cholera.

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

	Column I		Column II
(a)	Particulate matter	(i)	Chemical water pollutants
(b)	Detergents	(ii)	Non-degradable soil pollutants
(c)	Plastics	(iii)	Degradable soil pollutants
(d)	Vegetable peels	(iv)	Air pollutants

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

39. Refer to the given paragraph where few words have been italicised and select the correct option regarding this.

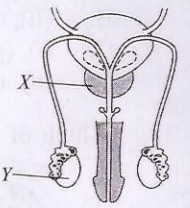
Animals used in agriculture and for transport are called *milch* animals whereas animals used for milk production are called *draught* animals. Production of good quality milk depends much on the type of breed *e.g.*, exotic breeds of cattle like *Red Sindhi* and *Jersey* produce on an average 60L milk in a day. On the other hand, local breeds such as *Sahiwal* and *Brown Swiss* produce on an average only 6 – 8L of milk per day. Cattle suffer from several diseases which may reduce the milk production. *E.g.*, anthrax is a fatal *viral* disease, whereas foot and mouth disease is a *bacterial* disease which broadly affect the health of cattle thereby, reducing milk production.

A. The positions of *Jersey* and *Sahiwal* should be interchanged.
B. The positions of *Red Sindhi* and *Brown Swiss* should be interchanged.
C. *Viral* should be replaced with *protozoan* and *bacterial* should be replaced with *fungal*.
D. *Milch* and *draught* should not be replaced as they are correctly mentioned.

40. *X* and *Y* are two systems of irrigation. *X* makes use of a simple machine, *i.e.*, wheel and axle and is animal driven. *Y*, on the other hand, involves network of narrow pipes with small holes which run through the crop field that are supplied by water through electrical pumps. Identify *X* and *Y* systems of irrigation and select the correct option regarding them.

A. *Y* system of irrigation is a wasteful process as the crop field gets flooded with excess water which is not required by the crop plants.
B. *X* irrigation system provides water to plants drop by drop so water is not wasted at all.
C. *Y* irrigation system is very useful in those regions where availability of water is very poor.
D. *X* irrigation system is best for watering fruit plants and trees.

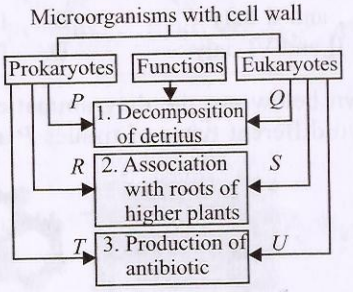
41. Refer to the given figure of male reproductive system.



Which of the following correctly describes difference between *X* and *Y*?

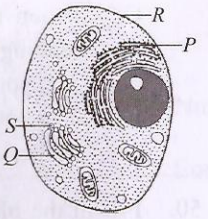
A. *X* is a gland but *Y* is not.
B. Both *X* and *Y* are glands but *X* is an endocrine gland while *Y* is an exocrine gland.
C. *Y* secretes male sex hormones but *X* does not.
D. *X* serves to produce sperms while *Y* serves to produce all other constituents of semen.

42. Refer to the given flow chart and identify *P*, *Q*, *R*, *S*, *T* and *U*.



	P	*Q*	*R*	*S*	*T*	*U*
A.	*Mycobacterium*	Yeast	*Vibrio*	*Aspergillus*	*Lactobacillus*	*Rhizopus*
B.	*Azotobacter*	*Agaricus*	*Salmonella*	*Puccinia*	*Diplococcus*	*Mucor*
C.	*Pseudomonas*	*Physarum*	*Rhizobium*	*Glomus*	*Streptococcus*	*Penicillium*
D.	*Vibrio*	*Mucor*	*Pseudomonas*	*Agaricus*	*Mycobacterium*	*Physarum*

43. Study the given diagram of an animal cell. Which of the following statements are correct regarding *P*, *Q*, *R* and *S*?



(i) *S* fuses with *R* to release its content into the extracellular space.

(ii) Proteins formed in *Q* are modified into glycoproteins in *P*.

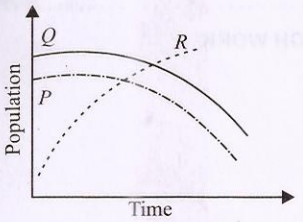
(iii) If radioactively labelled amino acids are provided to the cell then radioactivity will first appear in *S*.

(iv) *Q* is involved in the synthesis of *R*.

(v) *S* buds off from *cis* face of *Q*.

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

44. The given graph shows changes in populations of three species, *P*, *Q* and *R* in an ecosystem over time. Which of the following could not be inferred from the given graph?



A. Species *R* could be an alien species which may become invasive and drive away species *P* in near future.
B. Species *Q* could be a parasite which is exclusively found on *P*.
C. *P* and *Q* might undergo coextinction in near future.
D. *P* and *Q* compete with each other for same available resources however the nutrient and resource requirements of *P* and *R* could be different.

45. Which of the following is/are incorrectly matched?

(i)	To reduce harmful gases emitted by vehicles	– Have the vehicles checked regularly to ensure that colourless and odourless gases are emitted
(ii)	To dispose off radioactive waste	– Burn in an open area
(iii)	To prevent pollution of the sea	– Educate the public not to throw litter or dump refuse into the sea
(iv)	To get rid of human faeces	– Have pipes leading from homes to the river

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

ACHIEVERS SECTION

Direction : Read the given paragraph and answer questions 46 and 47.

Raj contracted measles few days back and soon recovered from the infection. He got immune to any subsequent infection of measles virus for sometime. Raj's mother got him vaccinated for polio when he was young. So, he is immune to polio disease also. Raj's younger brother Rohan is just two days old and is mother fed. He has received some immunity from his mother *via* milk.

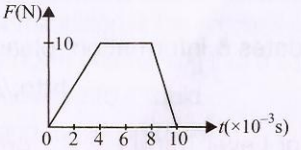
46. Which of the following is correct regarding Raj's and Rohan's immunity?

A. Raj's immune system developed its own antibodies when encountered the pathogen or antigen however, Rohan has received preformed antibodies from his mother.
B. Rohan's immunity is long lasting but Raj's immunity is for a brief period only.
C. Raj is immune to only few diseases like measles and polio however, Rohan is immune to most of the pathogenic diseases.
D. Rohan's immunity may cause some side effects in his body however Raj's immunity has no side effects.

47. How Raj got immune to polio virus even though he never contracted the disease?

A. The vaccine given to Raj contained live attenuated pathogens which triggered production of antibodies and memory cells that will recognise any subsequent pathogenic attack and prevent the infection.
B. The vaccine given to Raj contained preformed antibodies which will last throughout his life and prevent any further infection.
C. The vaccine given to Raj contained live/active pathogen in a very small amount that can generate primary immune response but is insufficient to cause infection.
D. None of these

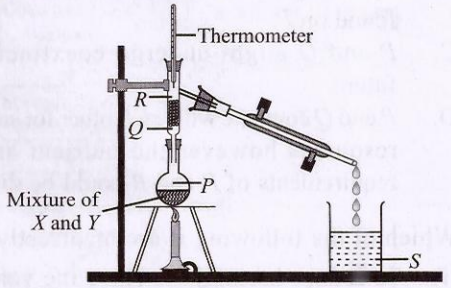
48. A particle of mass 70 g, moving at 50 cm s^{-1}, is acted upon by a variable force opposite to its direction of motion. The force *F* is shown as a function of time.



After the force stops acting, the particle moves with a speed of

A. 50 cm s^{-1} in reverse direction
B. 100 cm s^{-1} in reverse direction
C. 150 cm s^{-1} in original direction
D. 100 cm s^{-1} in original direction.

49. A mixture of two liquids X and Y was placed in a flask as shown in the given figure. The mixture was heated using a Bunsen burner. The boiling point of X is 230 K and that of Y is 250 K.



Which of the following statements is correct?

A. The purpose of fractionating column is to decrease the surface area for cooling.

B. As the vapour travel up from Q to R, the vapour of X condense more readily.

C. When the thermometer first shows a constant reading, point P will be richer in proportion of X vapours.

D. The liquid 'Y' distills over first and is collected in beaker S.

50. Fill in the blanks by choosing an appropriate option. On the surface of the earth, acceleration due to gravity at poles is __(i)__ and that at equator is __(ii)__. The value of acceleration due to gravity __(iii)__ with height above the centre of earth to its surface and __(iv)__ with height above the surface of earth.

	(i)	(ii)	(iii)	(iv)
A.	Maximum	Minimum	Increases	Decreases
B.	Maximum	Minimum	Decreases	Decreases
C.	Minimum	Maximum	Increases	Decreases
D.	Minimum	Maximum	Increases	Increases

SPACE FOR ROUGH WORK