SCIENCE OLYMPIAD FOUNDATION
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DPS Science & Mathematics TALENT EXAMINATION 2014-2015

Time : 2 hrs. Total Marks : 100

Guidelines for the Candidate

1. The paper consists of two sections –

   Science (60 Questions) : Physics (20 Questions), Chemistry (20 Questions) & Biology (20 Questions) and

   Mathematics (40 Questions)

2. All questions are compulsory and carry equal marks. There is no negative marking. Use of calculator is not permitted.
3. Write your Name, School Name and Roll No. clearly on the Answer sheet and do not forget to sign.
4. There is only one correct answer hence mark one choice only.
5. Darken your choice with **HB Pencil** or **Blue / Black Ball Point Pen** only.

   For Example :

   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

   16. ● Ⓑ Ⓒ Ⓓ

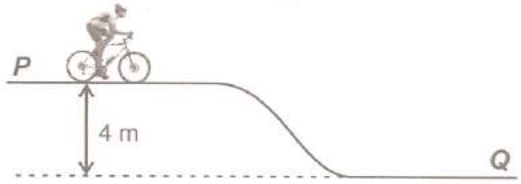
As the correct answer is option No. (A), the candidate should darken the circle corresponding to option No. (A)

6. Rough work should be done in the blank space provided in the booklet.

A Collaborative Project of DPS Society & Science Olympiad Foundation

PHYSICS

1. **A cyclist, with his bicycle has a total mass of 90 kg and is travelling with a constant speed of 15 m s^{-1} on a flat road at *P* as shown in the given figure. He goes down a small slope, thus descending 4 m. What is his speed at *Q*, assuming that there is no loss in energy due to friction? (Take g = 10 m s^{-2})**

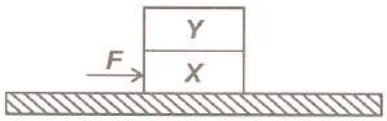


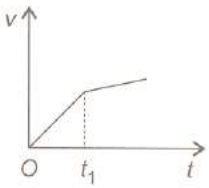
(A) 10 m s^{-1}
(B) 20.5 m s^{-1}
(C) 15 m s^{-1}
(D) 17.5 m s^{-1}

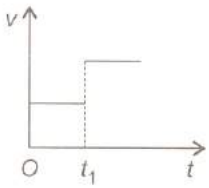
2. **When a massless spring is pulled and released, then**
(A) It comes back to the original position
(B) It starts oscillating
(C) Its potential energy will be converted to kinetic energy
(D) None of these.

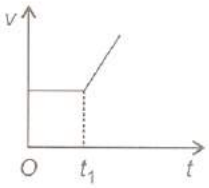
3. **An ultrasound machine in a medical health care centre uses a frequency of 20 MHz to diagnose human conditions. If the speed of sound in tissue is 1400 m s^{-1} and the penetration depth is about 200 wavelengths, then how deep can this penetrate?**
(A) 4.1×10^{-2} m (B) 1.4×10^{-2} m (C) 7.4×10^{-2} m (D) 4.7×10^{-2} m

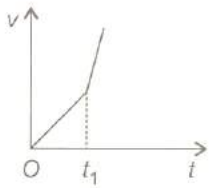
4. **The given figure shows two blocks *X* and *Y* of same mass being pushed across a rough horizontal surface by a constant force *F*. After sometime t_1, the block *Y* drops off but the force remains the same. Which graph correctly shows, how the speed *v* of the block *X* varies with time?**



(A)


(B)


(C)


(D)


5. **During a planned manoeuvre in a space flight, a free-floating astronaut A pushes another free-floating astronaut B, the mass of A being greater than that of B. Then, the magnitude of the force exerted by astronaut A on astronaut B is**
(A) Equal to zero
(B) Equal to the force exerted by B on A
(C) Greater than the force exerted by B on A
(D) Less than the force exerted by B on A.

6. **Match the Column I with Column II and choose the correct option.**

Column I	Column II
(a) Slope of displacement-time graph	(i) Velocity
(b) Slope of velocity-time graph	(ii) Distance
(c) Area under velocity-time graph	(iii) Acceleration
(d) Slope of line joining any two points on velocity-time graph	(iv) Average acceleration

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

7. **A stone is released from rest and falls freely due to gravity. If the acceleration of free fall is 10 m s^{-2}, which of the following option is correct?**

(A) The stone takes the same time to fall through the same distances.

(B) After 2.0 s, the acceleration is 20 m s^{-2}.

(C) The time taken to fall through the first 10 m is 1.0 s.

(D) For the first interval of 1.0 s, the average speed is 5 m s^{-1}.

8. **Read the given statements and mark the correct option.**

Statement 1 : In an elevator moving downward with some acceleration, the apparent weight of the body is less than its actual weight.

Statement 2 : Weight of the body is force with which the body is attracted towards the centre of the Earth.

(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.

9. **A body projected vertically from the Earth reaches a height equal to Earth's radius before returning to the Earth. The power exerted by the gravitational force is**

(A) Greatest at the highest position of the body

(B) Greatest at the instant just before the body hits the Earth

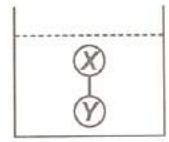
(C) Constant all through the motion.

(D) None of these.

10. **A man of mass 60 kg is standing in a gravity free space at a height of 12 m above the floor. He throws a stone of mass 0.5 kg downwards with a speed of 4 m s^{-1}. When the stone reaches the floor, the distance of the man above the floor will be**

(A) 10.1 m (B) 12.1 m (C) 15.2 m (D) 18.4 m

11. **Two solid spheres *X* and *Y* of equal volumes but of different densities ρ_X and ρ_Y are connected by a string. They are fully immersed in a fluid of density ρ_F. They get arranged in a manner as shown in figure. This arrangement is possible only if**



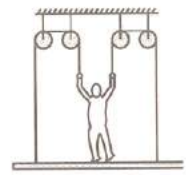
(A) $\rho_X < \rho_F$ (B) $\rho_X > \rho_F$

(C) $\rho_Y < \rho_F$ (D) $\rho_X + \rho_Y = \rho_F$

12. **A Centigrade and Fahrenheit thermometers are dipped in boiling water. The water temperature is lowered until the Fahrenheit thermometer registers 104°. The fall in temperature as registered by the Centigrade thermometer is**

(A) 30° (B) 40° (C) 50° (D) 60°

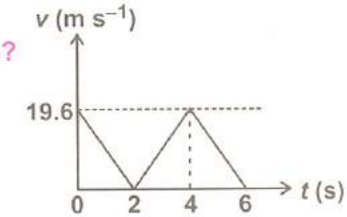
13. **A man of mass *m* stands on a platform of equal mass *m* and pulls himself by two ropes passing over pulleys as shown in the given figure. If he pulls each rope with a force equal to half his weight, his upward acceleration will be**



(A) g (B) $g/2$

(C) $g/3$ (D) Zero

14. **The velocity-time graph of a particle is as shown in the given figure Which of the following statements is correct about the motion of the particle?**



(A) It moves with a constant acceleration throughout.

(B) It moves with an acceleration of constant magnitude but changing direction at the end of every 2 second.

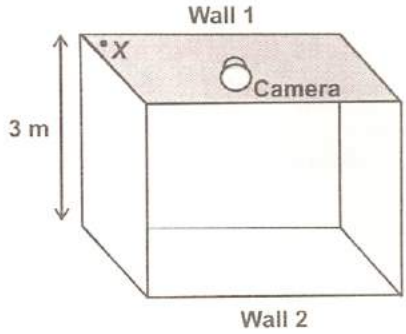
(C) The displacement of the particle after 4 second is zero.

(D) The velocity becomes zero at t = 4 second.

15. A body of mass 2 kg is thrown up vertically with a kinetic energy of 490 J. If the acceleration due to gravity is 9.8 m s^{-2}, the height at which the kinetic energy of the body becomes half of the original value is

(A) 50 m
(B) 25 m
(C) 12.5 m
(D) 10 m.

16. There is a cubical room with the wall 2 as a plane mirror. The length of each side of the room is 3 m. A camera is placed at the centre of the wall 1 which is vertically opposite to wall 2 as shown in the given figure. At what distance should the camera be focused to photograph an object *X* placed at corner of wall 1?



(A) 1.5 m
(B) 4.5 m
(C) $1.5\sqrt{17}$ m
(D) $4.5\sqrt{2}$ m

17. A particle has a velocity *u* towards east at $t = 0$. Its acceleration is towards west and is constant. x_A and x_B are the magnitude of displacements in the first 10 seconds and the next 10 seconds. The relation between x_A and x_B is

(A) $x_A < x_B$
(B) $x_A = x_B$
(C) $x_A > x_B$
(D) Insufficient information

18. A particle is going in a spiral path as shown in the given figure with constant speed. Which of the following statements is correct?

(A) The velocity of the particle is constant.
(B) The acceleration of the particle is constant.
(C) The magnitude of acceleration is constant.
(D) The magnitude of acceleration is decreasing continuously.

19. A stone is dropped in to a well and its splash is heard at the mouth of the well after an interval of 1.45 s. Find the depth of the well. (Given speed of sound in air is 332 m s^{-1})

(A) 3.3 m
(B) 6.6 m
(C) 7.3 m
(D) 9.9 m

20. A mirror is rotated through an angle θ about an axis passing through the point of incidence and in the plane of the mirror. The reflected ray will be rotated through

(A) $\frac{\theta}{2}$
(B) θ
(C) 2θ
(D) 4θ

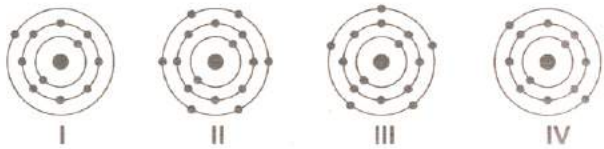
CHEMISTRY

21. In a sample of chlorine, it was found that some of the chlorine atoms had a nucleon number 35 and the rest had a nucleon number 37.
Identify the correct statements.

I. Both are isobars.
II. Both are isotopes.
III. Any one atom of chlorine has a fractional mass of 35.5 u.
IV. A certain amount of chlorine contains both isotopes of chlorine and the average mass is 35.5 u.

(A) I and III
(B) II and III
(C) I and IV
(D) II and IV

22. *P* and *Q* react to form a compound having chemical formula QP_3. Which of the following diagrams represent the electronic configurations of elements *P* and *Q* respectively?



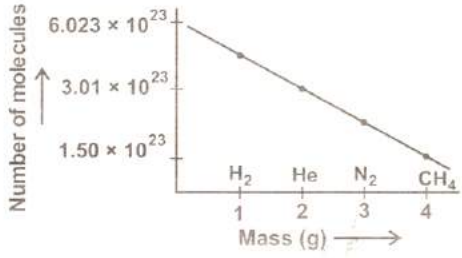
(A) I and III (B) IV and II (C) III and IV (D) III and I

23. An atom of an element *X*, contains eight protons. The element *X* and the ion formed by it to acquire noble gas configuration are

(A) O, O^- (B) O, O^{2-} (C) S, S^{2-} (D) O, O^{2+}

24. The graphical representation of number of molecules of different gases is given.
Which gases are placed at correct position?

(A) H_2, He
(B) N_2, CH_4
(C) He, CH_4
(D) H_2, CH_4



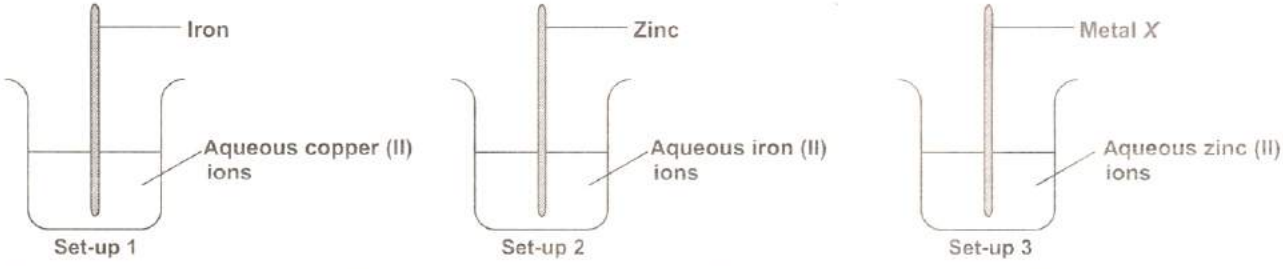
25. Two pure substances *X* and *Y* are obtained from elements *P* and *Q* by two different methods. Substance *X* has a mass of 2.25 g and contains 0.90 g of *Q*. Substance *Y* is made up of 60% *P* and 40% *Q* by weight. This is an illustration of

(A) Law of multiple proportion (B) Law of constant proportion
(C) Law of reciprocal proportion (D) Gay-Lussac's law of combining volumes

26. Anushka segregated the given items into biodegradable and non-biodegradable materials as

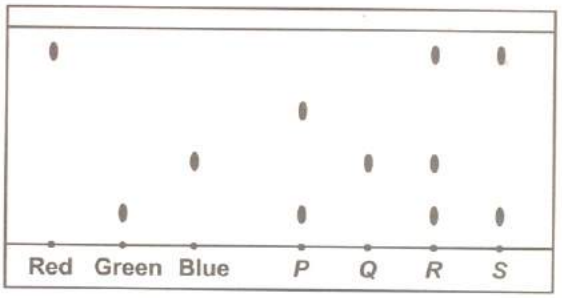
	Biodegradable	Non-biodegradable
(A)	I, II, VI	III, IV, V
(B)	I, III, V	II, IV, VI
(C)	I, II, IV, VI	III, V
(D)	I, II, III, V	IV, VI

27. Sumit investigated the reactivity of four metals, iron, copper, zinc and an unknown metal *X*. He arranged three experimental set-ups as shown below. He observed that reaction occurred in all the three set-ups. Identify the metal *X*.



(A) Cu (B) Mg (C) Fe (D) Au

28. Figure shows a chromatogram obtained using three single dyes red, green and blue, and also four unknown dye samples *P*, *Q*, *R* and *S*. Identify the correct statements.



I. Sample *P* contains green and blue dyes.
II. Sample *Q* contains only blue dye.
III. Sample *R* contains red, green and blue dyes.
IV. Sample *S* contains green and one unknown dye.

(A) I and IV (B) III and IV (C) II and III (D) II, III and IV

29. The table shows the colours of four solids *P*, *Q*, *R* and *S* and their solubilities in water.

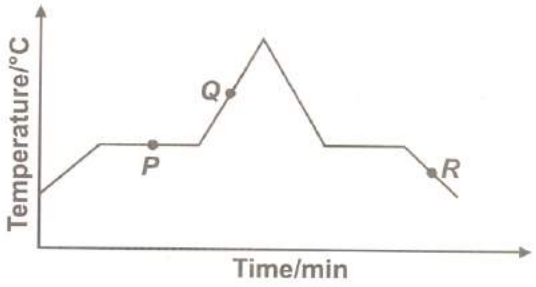
Solid	Colour	Solubility in water
P	Blue	Insoluble
Q	Blue	Soluble
R	White	Insoluble
S	White	Soluble

When a mixture containing two of the given solids, is added to excess of water, stirred and filtered, a colourless filtrate and blue residue are obtained.
Which two of the given solids are present in the mixture?

(A) *P* and *Q* (B) *P* and *R* (C) *Q* and *R* (D) *P* and *S*

30. Liquid *X* was heated to form a gas. It was then cooled to form a liquid again. The diagram below shows the graph of temperature against time for the experiment.
What are the physical states of *X* at *P*, *Q* and *R*?

	At *P*	At *Q*	At *R*
(A)	Liquid and Gas	Liquid	Gas
(B)	Liquid	Liquid and Gas	Gas
(C)	Gas	Liquid and Gas	Liquid
(D)	Liquid and Gas	Gas	Liquid



31. A student is asked to compare the processes — boiling and evaporation on the basis of temperature, speed and their effects. Which of the following comparisons between these two processes is/are correct?

S. No.	Boiling	Evaporation
I. Temperature	At boiling point	Above boiling point
II. Speed	Slow	Fast
III. Effect	No cooling	Cooling

(A) I only (B) II only (C) III only (D) I and III

32. The boiling point range of various petroleum fractions obtained from petroleum by using fractional distillation is shown in the given table.
Choose the incorrect statement.

Fraction	Boiling point (°C)
Petroleum gas	below 40
Petrol	40 – 70
Naphtha	70 – 150
Kerosene	150 – 250
Lubricating oil	250 – 300
Bitumen	over 300

(A) Petroleum gas is the first fraction to distil over.
(B) Bitumen is collected at the bottom of the fractionating column.
(C) Fractional distillation is used to separate miscible liquids which have very large difference in their boiling points.
(D) Petroleum gas is the most volatile fraction.

33. Element Z has the following properties :

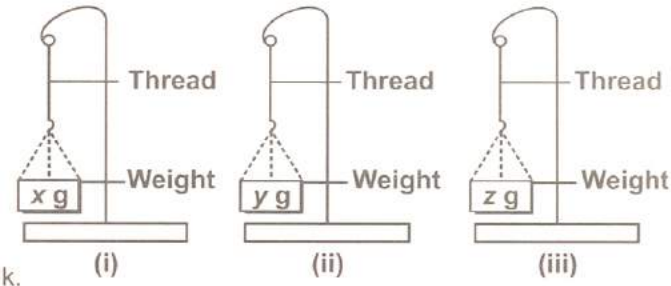
1. Composition of isotopes, $^{79}Z : {}^{81}Z = x : y$.

2. Average mass of an atom of Z is 20 times the mass of a helium atom.

$x : y$ is

(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 2 : 3

34. Mohit took 40 cm each of cotton, wool and nylon thread to check their tensile strength. He tied one end of the thread with the hook of an iron stand. By putting the weights x g, y g and z g on the other end, the thread finally broke. If $x > z > y$, then what did he conclude from the experiment?



(A) Thread in fig (i) is nylon, (ii) is cotton and (iii) is silk.
(B) Thread in fig (i) is cotton, (ii) is silk and (iii) is nylon.
(C) Thread in fig (i) is silk, (ii) is cotton and (iii) is nylon.
(D) Thread in fig (i) is silk, (ii) is nylon and (iii) is cotton.

35. Match the column I with column II and choose the correct option using the codes given below.

	Column I		Column II
(a)	A metal does not react with dilute hydrochloric acid.	(i)	Sodium
(b)	A non-metal which is soft and dull.	(ii)	Iodine
(c)	A non-metal used as an antiseptic.	(iii)	Phosphorus
(d)	A metal which is stored in kerosene.	(iv)	Copper
(e)	A non-metal which catches fire if exposed to air.	(v)	Sulphur

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

36. Read the following statements and mark the correct option.

Statement-I : Coal, petroleum and natural gas are exhaustible natural resources.

Statement-II : Exhaustible natural resources are renewable and present in unlimited quantity.

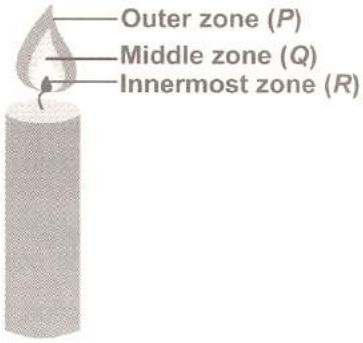
(A) Both statements I and II are true and statement II is the correct explanation of statement I.
(B) Both statements I and II are true but statement II is not the correct explanation of statement I.
(C) Statement I is true and statement II is false.
(D) Both statements I and II are false.

37. The process in which the wood of the forests was converted into coal under high temperature and pressure over millions of years is called

(A) Destructive distillation (B) Carbonisation (C) Pyrolysis (D) Fermentation

38. Observe different zones of candle flame and identify P, Q and R.

	P	Q	R
(A)	Complete combustion (yellow)	Partial combustion (blue)	Unburnt wax vapours (black)
(B)	Complete combustion (blue)	Partial combustion (yellow)	Unburnt wax vapours (black)
(C)	Partial combustion (yellow)	Complete combustion (blue)	Unburnt wax vapours (black)
(D)	Unburnt wax vapours (black)	Complete combustion (blue)	Partial combustion (yellow)



39. **Calorific values of different fuels are given in the table.**

Arrange these fuels in the increasing order of their efficiency.

(A) 2 < 5 < 1 < 4 < 3
(B) 4 < 3 < 5 < 2 < 1
(C) 3 > 4 > 5 > 2 > 1
(D) 3 < 4 < 1 < 5 < 2

S. No.	Fuel	Calorific value (kJ/kg)
1.	Kerosene	45,000
2.	Hydrogen	150,000
3.	Cow dung cake	6,000-8,000
4.	Biogas	35,000-40,000
5.	LPG	55,000

40. **The correct order of number of atoms of N_2O, O_2, CH_4 and CO_2 in 1 g of each, is**

(A) $CH_4 > O_2 > N_2O > CO_2$
(B) $CH_4 > N_2O = CO_2 > O_2$
(C) $O_2 > CH_4 > CO_2 = N_2O$
(D) $N_2O > CO_2 > CH_4 > O_2$

BIOLOGY

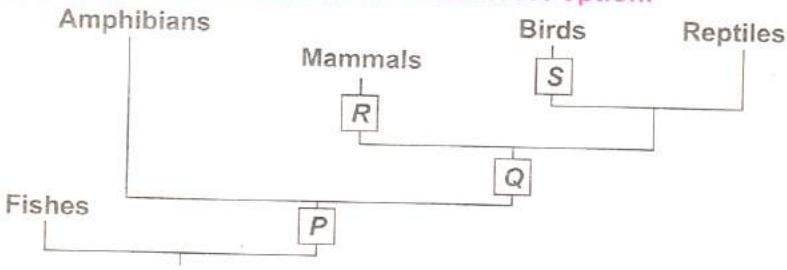
41. **Which of the following statements is true regarding the given agricultural implement?**

(A) It works more efficiently on the uneven land where sufficient water is unavailable.
(B) It ensures that seeds get covered by the soil.
(C) It helps to separate the healthy seeds from the damaged ones.
(D) It sows seeds about 20-25 cm deep in soil so that birds cannot eat them.

42. **Pancreatic tissue was removed from a freshly killed rat and was placed in warm isotonic saline solution. Later on, radioactively labelled amino acids were added to the solution. At intervals, after adding the amino acids, samples of the tissue were removed, sections were cut and the sites of radioactivity were determined. In which of the following cell organelles will the radioactivity first appear?**

(A) Rough endoplasmic reticulum
(B) Mitochondrion
(C) Golgi apparatus
(D) Lysosome

43. **A classification chart of vertebrates is given below which is based on the characteristics *P*, *Q*, *R* and *S*. Identify these characteristics and select the correct option.**



(A) *P*-Limbs
Q-Egg with amnion membrane
R-Milk production, hair
S-Feathers

(B) *P*-Egg with amnion membrane
Q-Milk production, hair
R-Limbs
S- Feathers

(C) *P*-Swim bladder
Q-Limbs
R-Milk production, hair
S-Feathers

(D) *P*-Milk production, hair
Q-Limbs
R-Egg with amnion membrane
S- Feathers

44. Read the following statements.

(I) _____ is the process by which the body produces antibodies against a disease through administration of specific vaccines.

(II) *Lactobacillus* is a _____ type of bacterium that helps in curdling of milk.

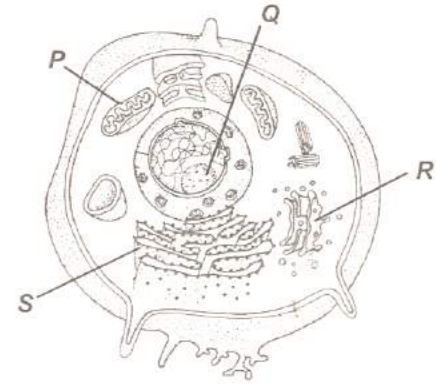
(III) Viruses are the acellular organisms which can be seen with _____ microscope.

(IV) Bacteria such as *Escherichia coli* living in the intestine of man and other vertebrates synthesize _____.

Select the option which correctly fills the blanks in any two of the statements.

(A) (I) Vaccination, (II) Coccus
(B) (II) Bacillus, (III) Light
(C) (III) Electron, (IV) Vitamin B complex
(D) (I) Immunization, (IV) Vitamin A

45. Identify the structures labelled as *P*, *Q*, *R* and *S* in the given figure of a cell and select the correct statement regarding these.



(A) '*P*' is the single membrane-bound organelle which oxidises food to release energy.

(B) '*Q*' is a dark-staining granular structure without a limiting membrane and contains RNA and proteins.

(C) '*R*' is an organelle which consists of a secretory *cis* face and a receiving *trans* face.

(D) '*S*' is a naked cell organelle which has ribosomes attached on its surface.

46. Select the incorrect statement.

(A) If a sperm containing X chromosome fertilizes the egg, the zygote would develop into a female.

(B) Pituitary gland produces thyroid-stimulating hormone (TSH), to stimulate production of thyroxine.

(C) Dolly was cloned by inserting a nucleus from the egg cell of a Scottish Blackface ewe into the enucleated udder cell of a Finn Dorset ewe.

(D) Adrenal glands regulate breathing, heart rate, carbohydrate metabolism and mineral balance in body.

47. Which of the following options is correct about vascular tissues of plants?

(A) Xylem consists of some dead and some living elements while phloem consists only of living elements.

(B) Xylem elements conduct the sap only in vertical direction while phloem elements conduct in both vertical and radial directions.

(C) Xylem has no role in providing mechanical strength to the plant while it is the primary function of phloem.

(D) Conduction in xylem is only unidirectional, whereas direction of conduction in phloem may get reversed periodically.

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

Statement 1 : In all aquatic animals, including bony fish and dolphins, the gametes are released into surrounding water and the process of fertilization occurs in water, outside the body.

Statement 2 : In external fertilization, a reduced number of gametes are produced because the chance of fertilization is rare.

(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 and statement 2 is false.

(D) Both statements 1 and 2 are false.

49. Which of the following is a common feature of all the *in situ* conservation establishments?

(A) Multiple commercial uses of land are permitted in particular zones.

(B) They are meant for the conservation of both flora and fauna.

(C) Activities related to the resource usage strategies, research and education are permitted.

(D) None of these

50. Read the following statements :

(I) *P* species is not likely to survive and is facing a high risk of extinction in the near future.

(II) Although present population of the *Q* species is sufficient but it is undergoing depletion and facing a risk of extinction in medium term future.

(III) *R* species exists in a small number, is very uncommon and localized only in certain geographical areas.

Identify *P*, *Q* and *R* and select the correct option.

	P	*Q*	*R*
(A)	Endangered	Vulnerable	Rare
(B)	Endangered	Rare	Vulnerable
(C)	Threatened	Endangered	Vulnerable
(D)	Vulnerable	Threatened	Endangered

51. Which of the following is the characteristic of manures which makes them more suitable, than fertilizers, for agricultural use?

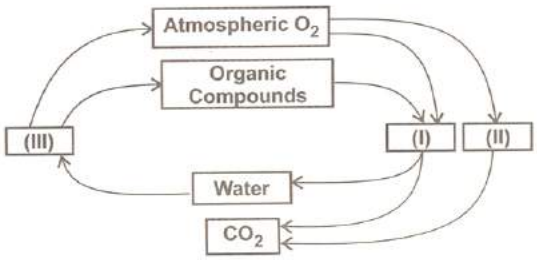
(A) Nutrients are released slowly, to match the high and rapid demand of nutrients of hybrid crop varieties.

(B) They are more bulky and voluminous than the fertilizers.

(C) The organic matter of manures attracts decomposers (microorganisms) and makes them flourish in the soil which enriches the nutrient quality of the soil.

(D) Unlike the fertilizers, manures are not nutrient-specific, *i.e.*, they supply all the different nutrients instead of a particular nutrient.

52. Study the given oxygen cycle and select the correct statement regarding this.



(A) (III) is the process on which all the living organisms depend directly or indirectly for food.

(B) (II) can be either respiration or decomposition.

(C) (III) represents an enzymatically controlled catabolic process.

(D) (III) and (I) counterbalance each other to maintain constant amount of oxygen in atmosphere.

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

	Column I		Column II
(a)	**Ozone depleting substances**	(i)	**CO_2, CH_4, N_2O**
(b)	**Green house gases**	(ii)	**Hexachlorobenzene, methyl mercury**
(c)	**Eutrophication**	(iii)	**$CFCl_3$, nitrogen oxides, sulphur oxides**
(d)	**Biomagnification**	(iv)	**Nitrates and phosphates**

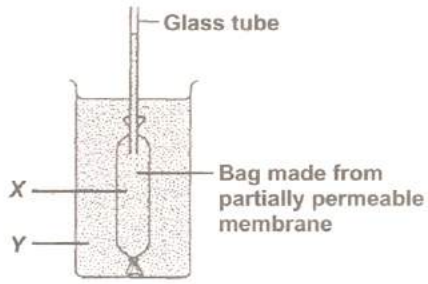
(A) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

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

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

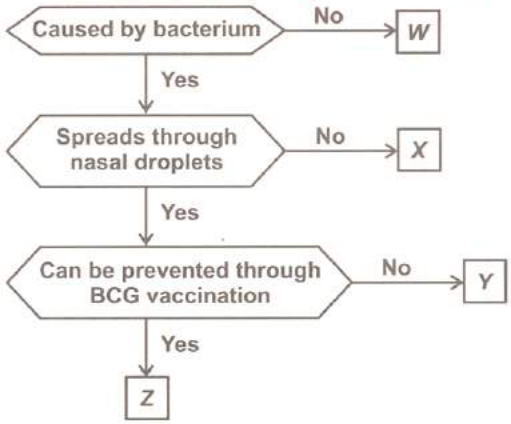
(D) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

54. The diagram shows an experimental set-up to investigate osmosis. After 3 hours, the liquid in the glass tube rises to its highest level. What could most likely be *X* and *Y*?



	Liquid *X* (inside the bag)	Liquid *Y* (in beaker)
(A)	Water	0.4 mol/dm^3 sucrose solution
(B)	0.4 mol/dm^3 salt solution	Water
(C)	Water	0.2 mol/dm^3 sucrose solution
(D)	Water	0.4 mol/dm^3 salt solution

55. Refer the given flowchart and select the correct option for *W*, *X*, *Y* and *Z*.



(A) *W* can be hepatitis and *X* can be cholera.
(B) *X* can be measles and *Y* can be tuberculosis.
(C) *W* can be poliomyelitis and *Z* can be hepatitis.
(D) *Y* can be pneumonia and *Z* can be cholera.

56. The extent of effects of acid rain has been found to depend upon the affected environment. Which of the following is correct regarding this?

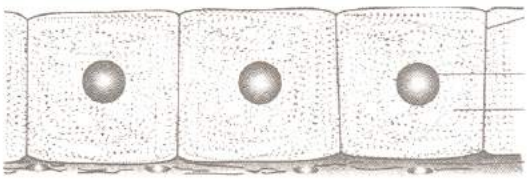
(A) Terrestrial habitats show more pronounced effects than aquatic habitats.
(B) Among aquatic habitats lakes and ponds are more damaged than the rivers.
(C) The extent of damage is dependent on the buffering capacity of the affected soil.
(D) Both (B) and (C)

57. Which of the following is not a common feature amongst the animals given in the box?

(A) Presence of bilateral symmetry
(B) Presence of true coelom
(C) Presence of three germ layers
(D) Presence of unsegmented body

Ascaris, Ancylostoma, Wuchereria, Enterobius

58. Which of the following statements does not hold true regarding the given animal tissue?



(A) In ovaries and testes, it is referred to as germinal epithelium as it produces gametes.
(B) The cells of this tissue appear polygonal in surface view.
(C) This tissue forms the lining of stomach, intestine, mammary glands and parts of urethra.
(D) Its function include protection, secretion, absorption, excretion, gamete formation, etc.

59. **Which of these is a list of only cross-breeded cows?**

(A) Jersey, Brown Swiss, Karan Swiss
(B) Karan Swiss, Gir, Tharparkar
(C) Karan Fries, Frieswal, Jersey
(D) Karan Swiss, Karan Fries, Frieswal

60. **Which of the following statements is not true regarding tuberculosis?**

(A) It is a chronic disease that lasts for a long time.
(B) It is an infectious disease that spreads through inhalation of infected bacterial spores.
(C) The causative organism of tuberculosis is *Corynebacterium*.
(D) It can be prevented through vaccination.

MATHEMATICS

61. **Three numbers p, q and r are such that $p^q = q^r$ where $p, q, r > 1$, then the correct relation between q and r is _____.**

(A) $q = r$
(B) $q < r$
(C) $q > r$
(D) Can't be determined

62. **In ΔABC, $\angle ACB = 120°$ and $\angle CAB = 40°$. AC is extended to P such that $AP = AC + 2CB$, then $\angle ABP =$ _____.**

(A) 100°
(B) 110°
(C) 150°
(D) 120°

63. **In a certain code 'what else can you do for me, Mr. Ajay' is written as 'you Mr. what can Ajay else do me for'. How will 'anyone else who can do such favour to me' be written in that code?**

(A) can to who anyone me else do favour such
(B) can favour anyone who me else do to such
(C) can to anyone who me else do such favour
(D) can to anyone who me else do favour such

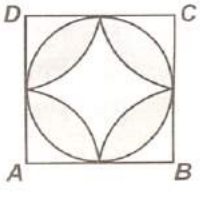
64. **Which of the following statements is INCORRECT with respect to Euclid's Geometry?**

(A) Things which are double the same things are equal to one another.
(B) Axioms are assumptions which are universal truths and are not to be proved.
(C) A surface has length and breadth only.
(D) Properties confirmed through reasoning based on axioms are called postulates.

65. **If $x = \frac{\sqrt{3}+1}{\sqrt{3}-1} + \frac{\sqrt{3}-1}{\sqrt{3}+1} + \frac{\sqrt{3}-2}{\sqrt{3}+2}$, then the value of $x^2 + \left(\frac{39}{x}\right)^2$ is _____.**

(A) 98
(B) 114
(C) $180 - 4\sqrt{3}$
(D) $322 + 4\sqrt{3}$

66. ***ABCD* is a square. A circle is inscribed in the square. Also taking *A*, *B*, *C*, *D* (the vertices of square) as the centres of four quadrants, drawn inside the circle, which are touching each other on the mid-points of the sides of square. Area of square is 4 cm². What is the area of the shaded region?**



(A) $\left(4 - \frac{3\pi}{2}\right)$ cm²
(B) $(2\pi - 4)$ cm²
(C) $(4 - 2\pi)$ cm²
(D) None of these

67. **If x and y be two positive numbers such that $9x^2 + 25y^2 = 661$ and $xy = 10$, then the value of $(5y - 3x)$, where $5y > 3x$ is _____.**

(A) 8
(B) 10
(C) 19
(D) 12

68. **The difference between simple and compound interest for four years is ₹ 11,115 at 20% p.a. What is the principle sum?**

(A) ₹ 10000
(B) ₹ 50625
(C) ₹ 40625
(D) ₹ 40000

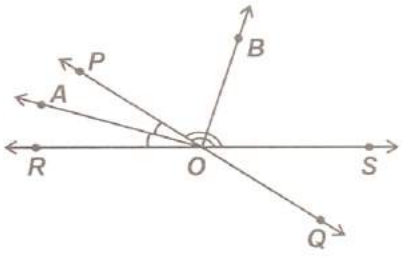
69. The factors of $(a^2 + 4b^2 + 4b - 4ab - 2a - 8)$ are _____.

(A) $(a - 2b - 4)(a - 2b + 2)$
(B) $(a - b + 2)(a - 4b - 4)$
(C) $(a + 2b - 4)(a + 2b + 2)$
(D) None of these

70. Mohit, Raj and Varun run on the circular path at the speed of 20 m/s, 30 m/s and 50 m/s respectively in the same direction. The circumference of the track (or path) is 600 m. When will they be together again for the first time at the starting point?

(A) 30 seconds
(B) 50 seconds
(C) 60 seconds
(D) 20 seconds

71. If lines PQ and RS intersect each other at point O, ray OA and ray OB bisect $\angle POR$ and $\angle POS$ respectively, if $\angle POA : \angle POB = 2 : 7$, then $\angle BOQ =$ _____.



(A) 120°
(B) 110°
(C) 150°
(D) 130°

72. Three of the following four are alike in a certain way based on their positions in the given arrangement and so form a group. Which is the one that does not belong to the group?

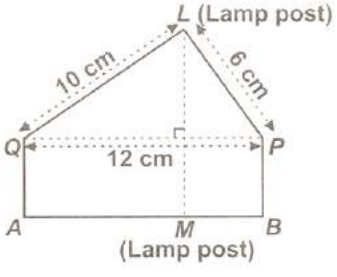
H T 6 # E 7 $ K I L % 3 P @ 2 A J ↑ R U 4 * V D

(A) KL$
(B) P23
(C) 2J@
(D) LI3

73. If the ordinate of a point is zero, then this point always lies _____.

(A) In the first quadrant only
(B) On the x-axis
(C) On the y-axis
(D) In the second quadrant only

74. L and M are two lamp posts as shown in figure given below. If the area of the ΔLQP is same as that of the rectangle $ABPQ$, find the distance between the two lamp posts.



(A) 7.89 cm
(B) 7.48 cm
(C) 6.78 cm
(D) 15 cm

75. Select a figure from the given options which satisfies the same condition of placement of the dots in the Figure (X).

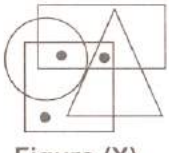
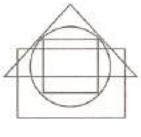


Figure (X)

(A) 
(B) 
(C) 
(D) 

76. Two dice are rolled simultaneously. The probability of getting a sum greater than 9 is _____.

(A) $\frac{11}{10}$
(B) $\frac{5}{6}$
(C) $\frac{1}{6}$
(D) $\frac{8}{9}$

DIRECTIONS (Q. 77 & 78) : Solve the following questions on the basis of the given data in following table:

Marks %	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Number of students	7	11	20	46	57	37	15	7

77. How many students obtained less than 50 marks?
(A) 78 (B) 84 (C) 25 (D) 64

78. How many students obtained at least 60 marks?
(A) 59 (B) 71 (C) 84 (D) 28

79. If it is possible to make a meaningful word from the fifth, seventh, eighth, ninth and thirteenth letters of the word EXTRAORDINARY using each letter only once, then the second letter of that word is your answer. If no such word can be formed, then 'X' is your answer and if more than one word can be formed, then 'M' is your answer.
(A) A (B) X (C) I (D) M

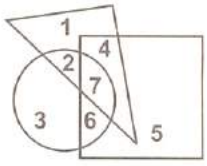
80. Out of the following numbers, which number is divisible by 132?
(A) 31218 (B) 78520 (C) 38148 (D) 52020

81. Which of the following statements is true?

Statement 1 : Two triangles are congruent if the sides and angles of one triangle are equal to the corresponding sides and angles of the other triangle.

Statement 2 : If two triangles are constructed which have all corresponding angles equal but have a pair of unequal corresponding sides, then the two triangles cannot be congruent to each other.
(A) Only Statement 1 (B) Only Statement 2
(C) Both Statement 1 and Statement 2 (D) Neither Statement 1 nor Statement 2

82. If beautiful is equivalent to circle, girls is equivalent to triangle and intelligent is equivalent to square, then which number will represent girls who are intelligent but not beautiful?



(A) 3 (B) 4
(C) 5 (D) 6

83. Factorise : $2x^4 - 13x^3 + 28x^2 - 23x + 6$
(A) $(x - 1)(x - 2)(2x - 1)(x - 3)$ (B) $(x - 1)(x - 2)(x - 3)(2x + 1)$
(C) $(x + 1)(x + 2)(x - 3)(2x - 1)$ (D) $(x - 1)(x - 2)(x - 3)(2x - 3)$

84. 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 operation of numbers progress from left to right.

(1) If an odd number is followed by another composite odd number, they are to be multiplied.
(2) If an even number is followed by an odd number, they are to be added.
(3) If an even number is followed by a number which is the perfect square, the even number is to be subtracted from the perfect square.
(4) If an odd number is followed by a prime odd number, the first number is to be divided by the second number.
(5) If an odd number is followed by an even number, the second one is to be subtracted from the first one.

14	11	9
104	q	11

If q is the resultant of the first row, what is the resultant of the second row?
(A) 1331 (B) 132 (C) 5 (D) 11

85. In triangles ABC and PQR, $AB = AC$, $\angle C = \angle P$ and $\angle B = \angle Q$. The two triangles are _____.

(A) Isosceles but not congruent
(B) Isosceles and congruent
(C) Congruent but not isosceles
(D) Neither congruent nor isosceles

86. Fill in the blanks.

The abscissa of a point on the y-axis is __P__. The point of intersection of the x-axis and y-axis in the cartesian plane is __Q__. The x-axis and y-axis divide the cartesian plane in __R__ quadrants. Signs of the coordinates of a point in the __S__ quadrant is (–, +).

	P	Q	R	S
(A)	0	Origin	4	First
(B)	1	Origin	8	Third
(C)	0	Origin	4	Second
(D)	1	Quadrant	8	Fourth

87. Which of the following statements is true?

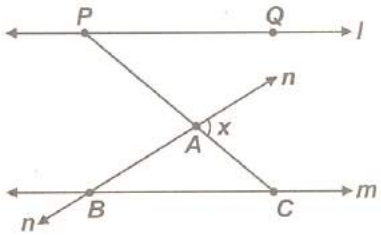
(i) Every rational number can be expressed in the form of terminating decimal expansion.
(ii) Decimal expansion of $\frac{2}{7}$ is of recurring form.
(iii) The number 0.21211211121111..... is an irrational number.

(A) Only (ii)
(B) Only (i)
(C) Both (i) and (ii)
(D) Both (ii) and (iii)

88. There are two containers A and B filled with oil with different prices and their volumes are 140 litres and 60 litres respectively. Equal quantities are drawn from both A and B in such a manner that the oil drawn from A is poured into B and the oil drawn from B is poured into A. The price per litre becomes equal in both A and B. How much oil is drawn from each of A and B?

(A) 40 litres
(B) 21 litres
(C) 42 litres
(D) Can't be determined

89. In the given figure, $l \parallel m$, $\angle ABC = 35°$ and $\angle APQ = 40°$. Find the value of x.



(A) 45°
(B) 85°
(C) 75°
(D) 105°

90. $ABCD$ is a quadrilateral such that $AB = 5$ cm, $BC = 4$ cm, $CD = 7$ cm, $AD = 6$ cm and diagonal $BD = 5$ cm. The area of the quadrilateral $ABCD$ is _____.

(A) 50 cm^2
(B) $66\sqrt{15}$ cm^2
(C) $\sqrt{110}$ cm^2
(D) $4(3+\sqrt{6})$ cm^2

91. How many linear equations in x and y can be satisfied by $x = 1$ and $y = 2$?

(A) Only one
(B) Infinitely many
(C) Two
(D) Three

92. Mr. Kapoor invested $\frac{1}{7}$ of his total investment at 4% and $\frac{1}{2}$ at 5% and rest at 6% for the one year and received total interest of ₹ 730. What is the total sum invested?

(A) ₹ 70000
(B) ₹ 14000
(C) ₹ 24000
(D) ₹ 38000

93. Find the missing character (?) in the given matrix, if a certain rule is followed row-wise or column-wise.

5	6	7
3	4	5
98	152	?

(A) 535
(B) 218
(C) 362
(D) 775

94. Three fair coins are tossed simultaneously. Find the probability of getting one tail.

(A) 1 (B) $\frac{1}{4}$ (C) $\frac{5}{8}$ (D) $\frac{3}{8}$

95. If the temperature of a liquid can be measured in kelvin units as $x°$ K or in Fahrenheit units as $y°$ F and the relation between the two systems of measurement of temperature is given by the linear equation $y = \frac{9}{5}(x - 273) + 32$.

If the temperature is 158°F, then find the temperature in Kelvin.

(A) 343° K (B) 148° K (C) 328° K (D) 214° K

96. If the driving wheel of a bicycle makes 560 revolutions in travelling 1.1 km. Find the diameter of the wheel.

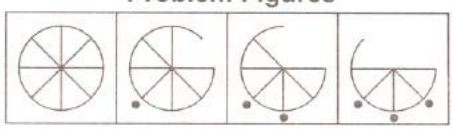
(A) 31.5 cm (B) 30.5 cm (C) 62.5 cm (D) None of these

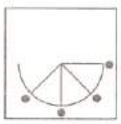
97. Sushant started from point *X* and travelled forward 8 km up to point *Y*, then turned towards right and travelled 5 km up to point *Z*, then turned right and travelled 7 km up to point *A* and then turned towards right and travelled 5 km up to *B*. What is the distance between points *B* and *X*?

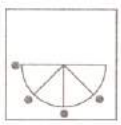
(A) 1 km (B) 2 km (C) 3 km (D) 4 km

98. Select a figure which will continue the series established by the four problem figures.

Problem Figures



(A) 

(B) 

(C) 

(D) 

99. The number of dimensions, a solid has _____.

(A) 0 (B) 1 (C) 2 (D) 3

100. A hollow garden roller of length 42 cm with a girth of 132 cm is made of iron 3 cm thick. The volume of the iron of the roller is _____.

(A) 15544 cm^3 (B) 15444 cm^3 (C) 15545 cm^3 (D) None of these

SPACE FOR ROUGH WORK