# INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE 2014-15
CONDUCTED ON 23RD NOVEMBER 2014

Code: JS 505

1. Number plate of a vehicle consists of 4 digits. The first digit is the square of second. The third digit is thrice the second and the fourth digit is twice the second. The sum of all 4 digits is thrice the first. The number is
    (A) 1132
    (B) 4264
    (C) 1642
    (D) 9396

2. The pteridophytic character that is considered to have led to the evolution of gymnosperms is:
    (A) homospory
    (B) furcate venation
    (C) hetersopory
    (D) sporophylls distinct from vegetative leaves

3. Seeds trapped in crevices of rocks soak in water, swell and cause fragmentation of rock. The process involved is termed:
    (A) Osmosis
    (B) Imbibition
    (C) Tyndall effect
    (D) Water potential

4. If the highest common factor of a, b and c is 1, where a, b and c belong to the set of natural numbers, then the highest common factor of (a X b) and c is
    (A) c
    (B) a X b
    (C) 1
    (D) insufficient data

5. If a firecracker burns with emission of red colour light, which cation is it likely to contain?
    (A) Lithium
    (B) Copper
    (C) Iron
    (D) Sodium

6. A positively charged insulator is brought in contact with an uncharged conductor then
    (A) conductor acquires positive charge due to conduction
    (B) conductor acquires positive charge due to induction
    (C) conductor acquires negative charge due to induction
    (D) conductor cannot acquire any charge

7. Two infinite wires carrying identical current are placed at position A and C normal to plane of the paper as shown in the adjacent figure. The resultant magnetic filed (B) at a point P on the perpendicular bisector is
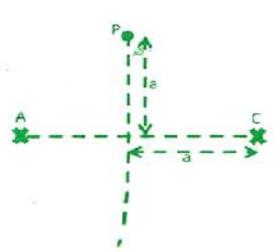
    (A) Along line parallel to AC and pointing towards right
    (B) Along line joining PC and pointing towards C
    (C) Along line joining PA and pointing towards A
    (D) Along perpendicular bisector pointing towards line AC

8. When an incandescent bulb is switched on and the outer glass bulb also gets heated up. This is due to
    (A) Convection of heat from filament to the bulb by the medium inside the bulb at all temperatures
    (B) Conduction and convection of heat from filament to the bulb by the medium inside the bulb at lower temperatures and by radiation of heat at higher temperatures
    (C) Radiation of heat from filament to the bulb at all temperatures
    (D) Conduction of heat from filament to the bulb by the medium inside the bulb at higher temperatures and by radiation of heat at lower temperature.

9. The least positive integer, n, such that 2 divides n, 3 divides n + 1, 4 divides n + 2, 5 divides n + 3 and 6 divides n + 4 is
(A) 62   (B) 120
(C) 720   (D) 52

10. Which of the following places having same number of species is considered most biodiverse?
(A) species belonging to more taxa
(B) many of the species economically important
(C) many of the species endemic
(D) species adapted to greater number of habitats

11. Axolotl, the Mexican Salamander, shows 'neoteny' or larva becoming sexually mature (adult). Which of the following characters indicate larval features in it?
i. Naked skin   ii. External gills
iii. Lidless eyes   iv. laterally compressed tail
v. Clawless digits
(A) Only ii and iv   (B) Only i, ii, iv and v
(C) Only ii, iii, iv and v   (D) i, ii, iii, iv and v

12. The solution set of the inequality $0 < \dfrac{x}{x+1} < 1, x \in R$ is
(A) Set of all positive real numbers   (B) Set of all real numbers except –1
(C) Set of all non – negative real numbers (D) Set of all numbers satisfying $0 \le x \le 1, \ x \in R$

13. Which among the following organic compounds is likely to have more than one possible structure?
(A) C_3H_6 (B) C_3H_8
(C) C_2H_4 (D) CH_4

14. In the circuit B_1, B_2 and B_3 represent identical bulbs. Consider the case
(i) With resistance R_4
(ii) Without the resistance R_4 (R_4 comparable with resistance of bulb)
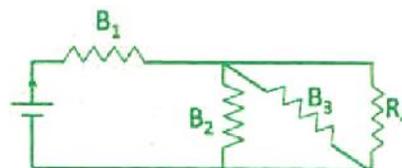
(A) B_1, B_2 and B_3 glow with equal brightness in both cases
(B) B_2B_3 brightest in case (i) and B_1 becomes brighter in (ii)
(C) B_1 brightest in (i) and in (ii) B_2 and B_3 become brighter and B_1 dimmer compared to case (i)
(D) B_1 brightest in (i) and B_2 becomes brighter in comparison to B_3 in (ii)

15. Three identical resistors each of resistance R are connected in the following four configuration. Rank the arrangement in the order of their equivalent resistors from highest to lowest

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

16. Given below are the structures of the famous molecules called Aspirin and Paracetamol. Which among the listed functional groups do the two molecules put together **NOT** contain?

Paracetamol   Aspirin
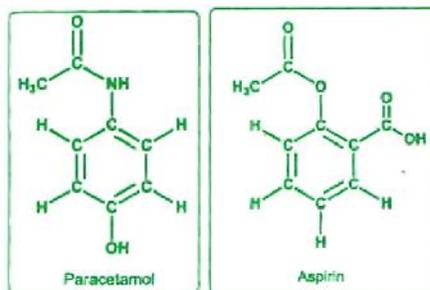
(A) Ester   (B) Ketone
(C) Alcohol   (D) Carboxylic acid

17. Most of the microbes employed in commercial fermentation for producing antibodies are:
(A) yeasts   (B) thread bacteria
(C) eubacteria   (D) ascomycete fungi

18. Most of the cellular RNA is synthesised and stored respectively in:
(A) cytoplasm and ribosomes   (B) ribosomes and cytoplasm
(C) ribosomes and nucleus   (D) nucleus and ribosomes

19. A number of bacteria are placed in a glass. 1 second later each bacterium divides in three, the next second each of the resulting bacteria divides in three again, and so on. After one minute glass is full. When was $1/9^{th}$ of the glass full?
(A) 15 sec   (B) 45 sec
(C) 58 sec   (D) 38 sec

20. A number x is a rational number if there exists integers p and q such that $x = p/q$. This is the definition of rational numbers in which
(A) both p and q can be zero   (B) both p and q should not be zero
(C) q can be zero but not p   (D) p can be zero but not q

21. There is a solution of 1 litre HCl of pH 5. When 9 L of water is added to this solution, the pH turns out to be
(A) pH 6   (B) pH 10
(C) pH 4   (D) pH 5 itself

22. A wave is sent along a string by oscillating at one end. If the tension in the string is increased then speed of the wave and wavelength of the wave.
(A) speed increases, wavelength decreases
(B) both increase
(C) both decreases
(D) wavelength increases, speed decreases

23. Clock A based on oscillations of spring and clock B is based on pendulum motion. Both the clocks keep the same time on earth. If they are taken to a planet having half the density of earth and twice the radius
(A) then A runs faster than B
(B) B runs faster than A
(C) both will run at equal faster rate than earth
(D) both will run at same rate at earth

24. Assuming ideal gas behavior, which among the following gases will have the least density under room temperature and pressure.
(A) Oxygen   (B) Nitrogen
(C) Ozone   (D) Fluorine

25. Consider the following two statements:
Statement 1 : The direction of acceleration of a particle must be always same as that of velocity.
Statement 2 : Acceleration is the rate of change of velocity.
Choose the correct option
(A) Statement (1) is correct while statement (2) is wrong
(B) Statement (1) and (2) are correct
(C) Statement (1) and (2) are wrong
(D) Statement (1) is wrong while statement (2) is correct

26. Rust is a mixture of
(A) $FeO + Fe(OH)_2$
(B) $FeO + Fe(OH)_3$
(C) $Fe_3O_4 + Fe(OH)_3$
(D) $Fe_2O_3 + Fe(OH)_3$

27. If the distance between A and B is 230 km, B and C is 120 km, C and A is 350 km. Also, if the distance between C and D is 200 km, distance between D and B is 330 km and distance from A to E is 100 km and distance between D and E is 570 km. The diagram (not drawn to scale) that represents this graphically is

(A)

(B)

(C)

(D)
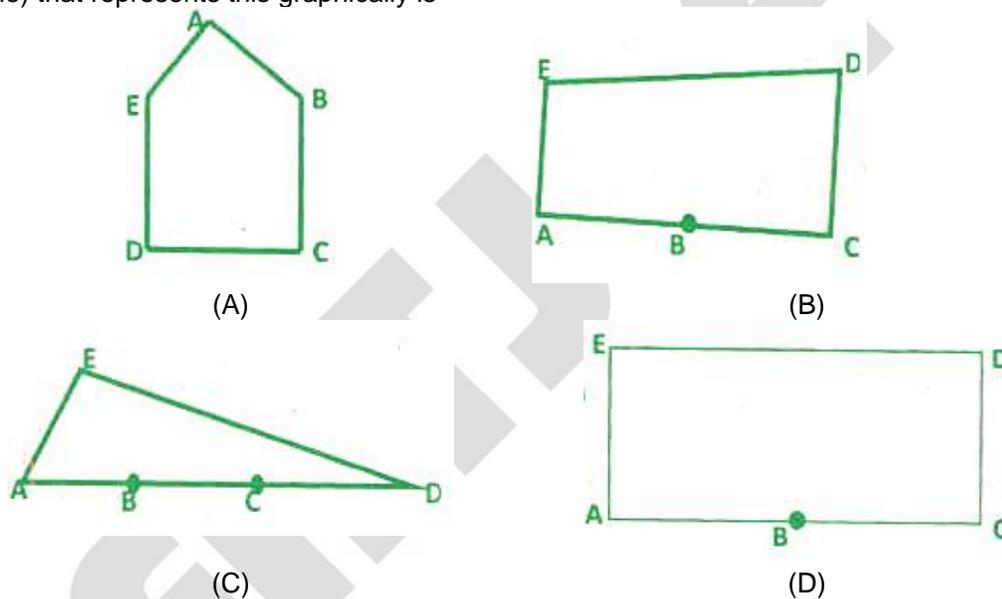
28. Which of the following contains the same number of atoms as 13.5 grams of aluminium?
(A) 20 g of calcium
(B) 10 g of magnesium
(C) 20 g of potassium
(D) 10 g of sodium

29. Consider the following two statements. Statement 1 is an assertion of a concept while statement 2 is the reason.
Statement (1) : When red light travels from air to water, for observer in water it appears to be still red.
Statement (2) : Colour of light is associated with frequency and frequency and frequency does not change, when it travels in different medium.
Choose the correct option
(A) Statement (1) is correct while statement (2) is wrong
(B) Statement (1) is wrong while statement (2) is correct
(C) Statement (1) and (2) are correct
(D) Statement (1) and (2) are wrong

30. A spring of spring constant 7600 Nm^{-1} is attached to a block of mass 0.25 kg as shown in figure. Frequency of oscillation on frictionless surfaces is

(A) 39.26 Hz   (B) 27.76 Hz
(C) 9681.5 Hz   (D) 98.39 Hz
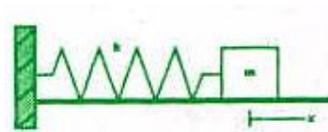
31. The following data was recorded for the reaction A + B → Product at 298 K

Experiment No.	[A]	[B]	Rate of reaction
1	1.00 M	0.15 M	4.20 x 10^{-3}
2.	2.00 M	0.15 M	8.40 x 10^{-3}
3.	1.00 M	0.30 M	8.40 x 10^{-3}

From the above data one can conclude that

(A) Rate $\infty [A]^2 [B]$

(B) Rate $\infty [A][B]^2$

(C) Rate $\infty [A]^2 [B]^2$

(D) Rate $\infty [A][B]$

32. The sum of 2 digits x and y is divisible by 7. What can one say about a 3 digit number formed by these two digits.
(A) xxy is divisible by 7   (B) xyx is divisible by 7
(C) xyx is divisible by 7^2 (D) yyx is divisible by 7

33. Snakes, the cold blooded animals, flick their bifid tounge often to:
(A) sense vibrations in earth   (B) sample air for chemoreceptors
(C) sense the nature of substratum   (D) sense the temperature of air

34. We all know that the sky appears to touch the ground at a distance. The distance at which we perceive the sky to touch the ground is called horizon. The reason for the perception is due to the fact that the Earth is a sphere (almost) and not a flat surface. Which of these pictures below accurately depict the horizon for a person standing on a high rise building like Burj Khalifa in Dubai? (Here, 'h' represents the height of the building while line 'H' represents the horizon)

(A)   (B)   (C)   (D)
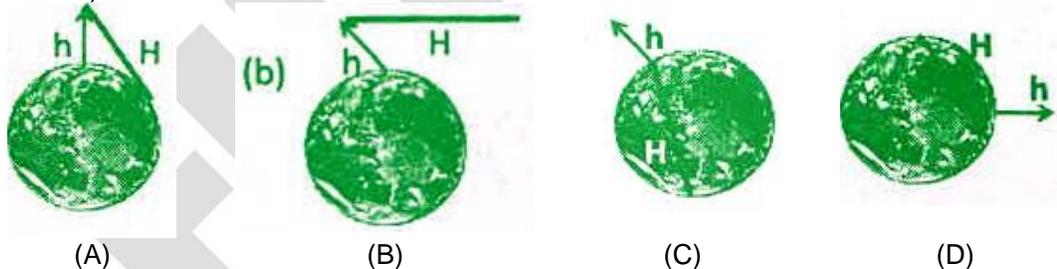
35. Sulphuric acid is manufactured by the contact process in which sulphur dioxide reacts with oxygen in presence of a catalyst. If 5.6 moles of SO_2 reacts with 4.8 moles of O_2 and a large excess of water, the maximum number of moles of H_2SO_4 that can be obtained is
(A) 11.2   (B) 5.6
(C) 4.8   (D) 1.4

36. The element essential for determining the three dimensional structure of proteins is:
(A) sulphur   (B) hydrogen
(C) nitrogen   (D) carbon

37. The general indigestion experienced by a patient suffering from obstructive jaundice is due to:
(A) the lack of emulsification of lipids.
(B) the acceleration of intestinal peristalsis reducing the retention time for food
(C) the low pH in the intestine not supporting optimal activity of enzymes.
(D) the diffusion of bile pigments in blood suppressing secretion of digestive juices.

38. A number is said to be a triangular number if it is the sum of consecutive numbers beginning with 1. Which one of the following is not a triangular number.
(A) 1431 (B) 190
(C) 28 (D) 506

39. The equivalent weight of $MnSO_4$ is half its molecular weight when it is converted to
(A) Mn_2O_3 (B) MnO_4
(C) MnO_2 (D) MnO_4

40. A light source of diameter 2 cm is placed 20 cm behind a circular opaque disc of diameter 4 cm. Shadow is formed on a screen at a distance of 80 cm. The ratio of the area of umbra and penumbra shadow regions is equal to
(A) 0.58
(B) 0.22
(C) 0.18
(D) 0.11
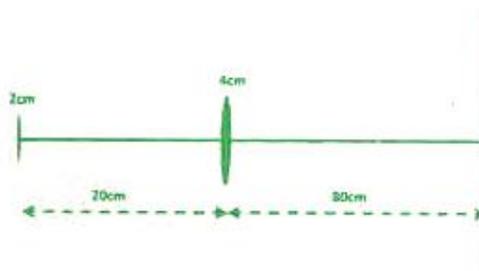
41. Which of the following sugars tastes most sweet?
(A) Ribose (B) Fructose
(C) Sucrose (D) Lactose

42. Scientists in an R & D company three design improvements on a car the first saves 50% of fuel, the second saves 30% of fuel and the third saves 20%. If the company implements all three design changes at once, the new car will consume fuel that is _____%of the fuel consumption of normal car
(A) 50% (B) 100%
(C) 28% (D) 20%

43. Aluminium is extracted from its oxide by
(A) Electrolysis (B) Reduction
(C) Thermal decomposition (D) Calcination

44. The magnetic force on a moving charged particle can change the particle's
(A) speed only (B) Both speed and direction
(C) direction only (D) neither of speed nor direction

45. A ray of light is incident on system of mirror as shown in the adjacent figure. What is the total deflection (a) of the ray when it emerges out after two reflections?
(A) 220° (B) 180°
(C) 120° (D) 140°
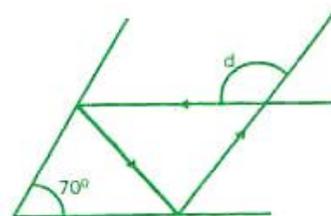
46. The oxidation number of sulphur is sodium thiosulphate $(Na_2S_2O_3)$ is
(A) +1 (B) +3
(C) +2 (D) +4

47. The adjacent figure is a modification of the Switzerland flag to suit the problem! Five identical small squares form the central cross. The length of each side of the big square is 10 m. If the area of the white cross is 20% of the area of the square flag, then the length of the side of the small square is

(A) 2 m (B) 2.25 m
(C) 1.6 m (D) 1.75 m
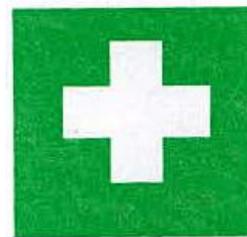
48. The algae belonging to which group can sustain normal growth at the greater depth of ocean?
(A) Red algae (B) Blue – green algae
(C) Brown algae (D) Green algae

49. The largest of the jelly – fishes grow over 1 metre in diameter and can survive without any skeletal support due to :
(A) rapid beating of cilia creating an upthrust
(B) the bottom dwelling habit
(C) upwelling currents in water
(D) high salinity and subsequent buoyancy of sea water .

50. The diagram show a road network. All vehicles drive in one direction from A to B numbers represent the maximum flow rate (capacity of roads) in vehicles per hour. The maximum number of vehicles that can drive through the network every hour is

(A) 315
(B) 240
(C) 215
(D) 340

51. An excess of NaOH solution is added gradually to an aqueous solution of $ZnSO_4$. Which of the following will happen?
(A) A white precipitate is formed which does not dissolve in excess NaOH
(B) A green precipitate is formed which dissolves in excess NaOH
(C) No observable change occurs
(D) A white precipitate is formed which dissolves in excess NaOH.

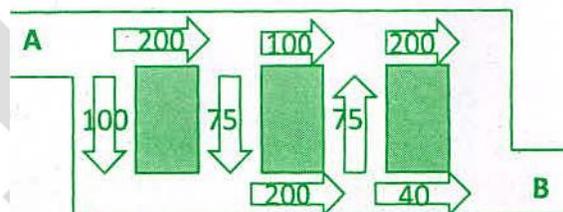52. If two bodies of different masses, initially at rest, are acted upon by the same force of the same time, then both bodies acquire the same
(A) velocity (B) acceleration
(C) momentum (D) kinetic energy

53. It is more difficult to walk on a sandy road than on a concrete road. The most appropriate reason for this is
(A) the sand is grainy but concrete is solid
(B) the friction between sand an deft is less than hat between concrete and feet
(C) the friction between sand and feet
(D) sand is soft and concrete is hard

54. In which of the following series of transition metal ions, all metal ions have $3d^2$ electronic configuration?
(A) Ti^+, V^{4+}, Cr^{6+}, Mn^{7+} (B) Ti^{3+}, V^{2+}, Cr^{3+}, Mn^{4+}
(C) Ti^{2+}, V^{3+}, Cr^{4+}, Mn^{5+} (D) Ti^{4+}, V^{3+}, Cr^{2+}, Mn^{3+}

55. A piece of wire 60 cm long is cut into two parts, one of them being 24 cm long. Each part is then bent to form a square. The ratio of the area of the larger square to the smaller square is
(A) 9/4 (B) 7/4
(C) 3/2 (D) 11/3

56. In the cells of oil seeds which of the cell organelles have to be more active?
(A) Mitochondria (B) Rough Endoplasmic Reticulum
(C) Smooth Endoplasmic Reticulum (D) Nucleoli

57. A rectangular parallelepiped with sides a, b and c in the ratio 3 : 2 : 1 is kept on a uniformly rough horizontal surface as shown in the figures below. The value of limiting friction is

(i)   (ii)   (iii)
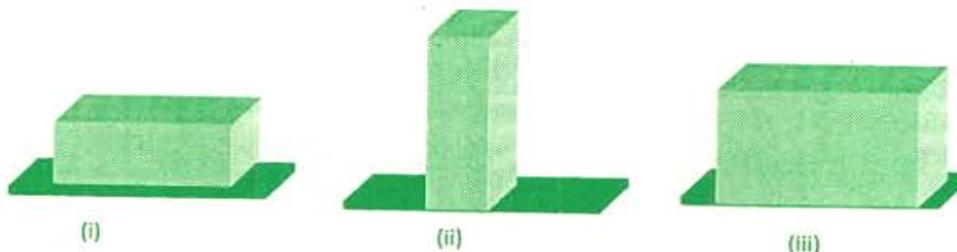
(A) Same in all cases (B) Minimum in (ii)
(C) Minimum in (iii) (D) Minimum in (i)

58. Which of the following has the maximum number of unpaired electrons?
(A) Ti^{3+} (B) V^{3+}
(C) Fe^{2+} (D) Fe^{3+}

59. The houses of a row are numbered consecutively form 1 to 49. Find the value of x such that the sum of the numbers of houses preceding the house numbered x is equal to the sum of the numbers of the houses following it
(A) 25 (B) 35
(C) 37 (D) No such value exists

60. Urea is the principle excretory waste in larval as well as adult phase of
(A) Cockroach (B) Crab
(C) Frog (D) Starfish

61. Use of excessive NKP fertilizers has resulted in
(i) Reduction in number as well as species of nitrogen fixing bacteria
(ii) Increase in number as well as types of denitrifying bacteria
(iii) Increase in the proportion of coarse particles in soil.
(iv) Increase in number as well as types of ammonifying microbes
(v) Increase in number as well as types of nitrifying bacteria
(A) only I, ii and iii (B) only ii, iv and v
(C) only I and ii (D) I, ii, iii and v

62. Along a road lie an odd n umber of stones placed at intervals of 10 metre. These stones have to be assembled around the middle stone. A person can carry only one stone at a time. If a man starts from one of the end stones and by carrying them in succession he covers 3 km to pile all stones at the centre. The number of stones is then
(A) 12 (B) 15
(C) 30 (D) 25

63. The following variation of properties is generally seen in the periodic table
(A) Atomic radius and ionization energy both increase across a period.
(B) Atomic radius increases and ionization energy decreases across a period.
(C) Atomic radius and ionization energy both decreases across a period.
(D) Atomic radius decrease and ionization energy increases across a period.

64. The erythrocytes separated from human blood were mixed with certain fluids on a slide and observed under the microscope. Which of the following will be the expected result?
(A) With serum the cells clump and coagulate.
(B) With distilled water the cells swell and eventually burst.
(C) With sea water the cells undergo no apparent change.
(D) With tap water cells shrink and appear cremated.

65. An inflated balloon with a heavy rock ties to it submerges in water. As the balloon sinks deeper and deeper, the buoyant force acting on it
(A) increases   (B) remains nearly unchanged
(C) decreases   (D) initially increases and then decreases

66. For a first order reaction, the ratio of the times taken for the completion of 99.9% and 50% of the reaction is
(A) 8   (B) 9
(C) 12   (D) 10

67. If set of marbles, of radius 5 cm, is poured into a cube of side 1 m. the maximum number of marbles that can be filled into the box are
(A) 2000   (B) 1000
(C) 1500   (D) 3000

68. Most of the insects have egg, larva, pupa and adult stages in the life cycle. This is primarily due to
(A) relatively short adult phase   (B) terrestrial habitat they have adapted to
(C) flying mode of locomotion majority have (D) eggs string little reserved food

69. Which of the following has been proved to contribute to the transport of water in vascular plants?
(i) Positive root pressure
(ii) Hyrophillic cell walls
(iii) Capillarity
(iv) Transpirational pull
(v) cohesion between water molecules
(A) (i), (ii), (iii), (iv) and (v)   (B) only (i), (iii) and (v)
(C) only (i), (ii), (iv) and (v)   (D) only (ii), (iv) and (v)

70. A round table cover has six equal designs as shown in the adjacent figure. If the radius of the cover is 4 cm, then cost of making the designs at the rte of Rs. 10.00 per cm^2 (round off your answer to a nearest rupee) is
(A) Rs. 85   (B) Rs. 86
(C) Rs. 90   (D) Rs. 87

71. Which of the following series of elements have nearly the same atomic radii?
(A) Fe, Co, Ni, Cu   (B) Na, K, Rb, Cs
(C) Li, Be, B, C   (D) F, Cl, Br, I

72. A particle is moving along a straight line. Its velocity time graph is as shown in the adjacent figure. Then match the following:

Physical quantity	Remarks
(i) Acceleration at 4 second	(p) Positive
(ii) Velocity at 4 second	(q) Negative
(iii) Direction of motion at 2 second	(r) Zero

(A) (i) is (p) ; (ii) is (q) and (iii) is (r)   (B) (i) is (r) ; (ii) is (r) and (iii) is (p)
(C) (i) is (q) ; (ii) is (r) and (iii) is (p)   (D) (i) is (q) ; (ii) is (p) and (iii) is (r)

73. Three identical vessels carrying equal amount of water are placed in three lifts. Lift A is accelerating upwards, lift B is accelerating downwards while lift C is moving up with constant velocity. The pressure at a depth h from free surface in the three vessel is measured as p_A, p_B and p_C then which of the following is true
(A) $p_A = p_C > p_B$ (B) $p_A > p_C > p_B$
(C) $p_A = p_C = p_B$ (D) $p_A > p_C = p_B$

74. In the reaction,
$2KClO_3 \longrightarrow 2KCl + 3O_2$
What is the volume of oxygen released under NTP conditions when 36.75 g of $KClO_3$ is heated?
(A) 3.6 litres   (B) 7.2 litres
(C) 18 litres   (D) 10 litres

75. Figure shows a square grid of order 3, which of the following is correct formula for the total number of squares in a similar grid of order n.

(A) $\dfrac{n(n+1)}{2}$ (B) $\dfrac{n^2(n+1)^2}{4}$

(C) $\dfrac{n(n+1)(2n+1)}{6}$ (D) $\dfrac{n(n+1)(n+2)}{6}$

76. If the distance between genes – W, X, Y and Z on a chromosome are as follows: from W-Y is 18 units, W-X is 26 units, W-Z is 40 units, X-Y is 8 units and X-Z is 14 units, the sequence of W, X, Y, Z genes on the chromosome would be
(A) W, Y, X, Z   (B) X, Y, W, Z
(C) Y, W, X, Z   (D) W, X, Y, Z

77. In a plant 30 megaspore mother cells are generated. If all the ovules are fertilised, how many seeds are expected to be formed?
(A) 60   (B) 30
(C) 90   (D) 120

78. A water filter advertisement claims to provide 8 litres of water per hour. How much time does it take to fill four bottles of 1.5 litres each?
(A) 2 hr   (B) 1 hr
(C) 30 min   (D) 45 min

79. Which among the following salts will not change the pH of water on addition
(A) Sodium cyanide   (B) Sodium chloride
(C) Sodium bicarbonate   (D) Sodium carbonate

80. A particle starting from rest is moving with uniform acceleration in a straight line. The percentage increase of the displacement of the particle in 9th second compared to that in the immediate previous second is about

(A) 8.3% (B) 20.6%

(C) 13.3% (D) 24.5%

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ANSWER KEYS
Code: JS 505

ANSWERS

1.	**D**	2.	**D**	3.	**B**	4.	**D**
5.	**A**	6.	**A**	7.	**A**	8.	**A**
9.	**A**	10.	**D**	11.	**C**	12.	**A**
13.	**A**	14.	**C**	15.	**D**	16.	**B**
17.	**C**	18.	**D**	19.	**C**	20.	**D**
21.	**A**	22.	**B**	23.	**D**	24.	**B**
25.	**D**	26.	**D**	27.	***(NONE)**	28.	**A**
29.	**C**	30.	**B**	31.	**D**	32.	**B**
33.	**A**	34.	**A**	35.	**B**	36.	**A**
37.	**A**	38.	**D**	39.	**C**	40.	**B**
41.	**B**	42.	**C**	43.	**A**	44.	**C**
45.	**D**	46.	**C**	47.	**A**	48.	**A**
49.	**C**	50.	**C**	51.	**D**	52.	**C**
53.	**B**	54.	**C**	55.	**A**	56.	**C**
57.	**A**	58.	**D**	59.	**B**	60.	**D**
61.	**A**	62.	**D**	63.	**D**	64.	**B**
65.	**B**	66.	**D**	67.	**C**	68.	**C**
69.	**D**	70.	**D**	71.	**A**	72.	**C**
73.	**B**	74.	**D**	75.	**C**	76.	**D**
77.	**D**	78.	**D**	79.	**B**	80.	**C**