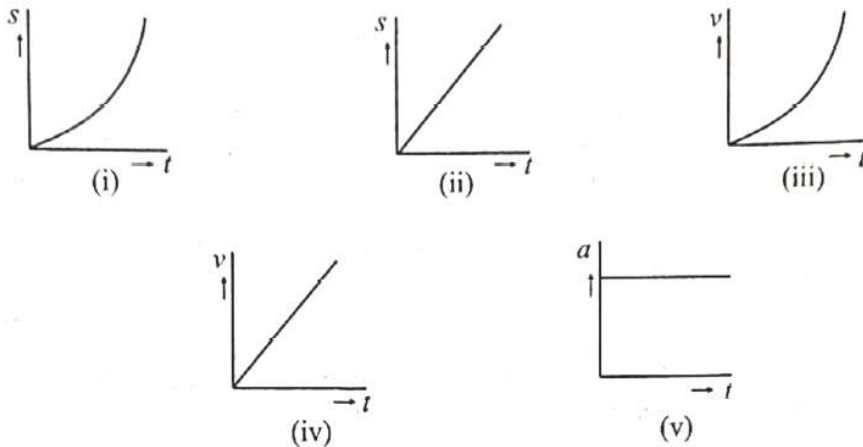


**INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE (NSEJS) 2022 – 23
Question Paper Code: 54
Held on: November 27, 2022**

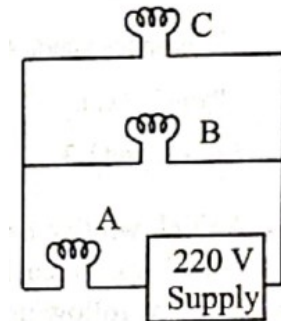
QUESTION PAPER

1. Figure (i) to (v) show graphical representation of motion in one – dimension. Here s , v , a , and t represent the displacement, the velocity, the acceleration and the time respectively.



Which of the above graphs represent uniform motion?

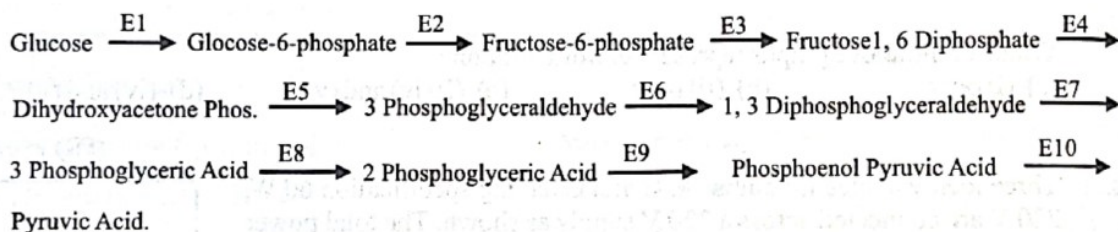
- (a) (i) only
(b) (ii) only
(c) (i) (iv) and (v)
(d) (iv) and (v)
2. Three identical electric bulbs A, B and C having specification 60W, 220 V are connected across a 220 V supply as shown. The total power dissipated in three bulbs is close to
- (a) 180 W
(b) 60 W
(c) 30 W
(d) 40 W



3. A copper wire is stretched to decrease its radius by 0.15%. The percentage change in the resistance of wire is
- (a) +0.3%
(b) -0.3%
(c) +0.6%
(d) -0.6%
4. Speed of sound in air is directly proportional to square root of absolute temperature of air (keeping other parameters constant). The speed of sound in air at 273K and 1 atm is 332 m/s. On a clear day, when temperature in the laboratory was 27° C, an experiment was performed to measure speed of sound in air in the laboratory. The measured value comes out to be 352 m/s. the percentage error in this measurement is

- (a) 0.2% (b) 1.15%
(c) 3.15% (d) 6.02%

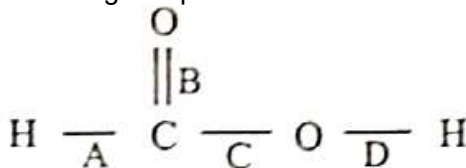
5. In some plants and fungi, some cell organelles are found which convert lipids to sugar in early stage of oil seed's germination. What are these?
(a) Glyoxysomes (b) Lysosomes
(c) Ribosomes (d) Liposomes
6. In the analysis of waste water, Escherichia coli is used as:
(a) A standard organism for performing a plate count
(b) An indicator of fecal contamination of water
(c) An indicator of the number of N_2 fixing bacteria in water
(d) A measure of the amino acid content of water
7. Acid rain damages soil and lakes. Its high level depositions have damaged high altitude forests since being encircled by acidic fogs and clouds. It also affects aquatic plants and animals. Which pH range is most suitable for the survival of aquatic biota?
(a) 4.5 – 4.8 (b) 6.5 – 7.5
(c) 7.5 – 8.5 (d) Above 9.0
8. Steroid hormones include sex hormones and hormones from adrenal cortex. Based on the intensity of action which of the following ovarian hormones is produced in large amount?
(a) Estrone (b) Estriol
(c) Estradiol (d) Estrane
9. In the vertebrae column of man, there are about 26 vertebrae. Which of the following vertebrae is related with the pelvis region?
(a) Lumbar (b) Coccygeal
(c) Sacral (d) Cervical
10. In the following EMP pathway, enzymes catalyzing the reactions are numbered E_1 to E_{10} . At which enzyme level, ATPs are generated at substrate level?



- (a) E1 and E3 (b) E3 and E6
(c) E7 and E10 (d) E6 and E10

11. A thick whitish band of semicircular nerve fibres is found bulging upon the inner surface of the dorsal wall of each cerebral hemisphere of mammalian brain. Choose the name of this structure from the following
(a) Corpus albicans (b) Corpus luteum
(c) Corpus stratum (d) Corpus callosum
12. In animal classification, symmetry of body is a diagnostic feature. Besides truly bilateral symmetrical animals, exceptionally some other animals also exhibit bilateral symmetry. Which of the following is an example of such animals?
(a) Giardia (b) Cliona
(c) Obelia (d) Trypanosoma
13. Nissl's granules are in fact RNA bodies, in which of the following do they occur?

- (a) Osteon (b) Chondrion
(c) Neurons (d) Myocytes
14. One of the following statements is not applicable to viruses
(a) The protein capsid of the virus does not enter the host cell
(b) The genetic material is either DNA or RNA, never both
(c) The virion replicates autonomously outside the host
(d) The virus replicates in a bacterial or other host cell
15. Carolus Linnaeus, a Swedish botanist is credited with Binomial Nomenclature of plants and animals, While using binomials, he devised a system of classification of plants. His classification is:
(a) Artificial (b) Natural
(c) Phylogenetic (d) Cladistic
16. Which bond will break when following compound is dissolved in water?

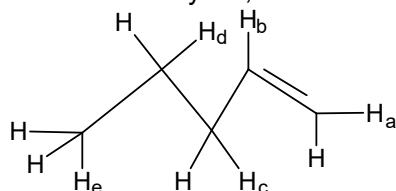


- (a) A (b) B
(c) C (d) D
17. If the number of compounds formed by H, C, Cl and Co are N_1, N_2, N_3, N_4 respectively, then correct order is
(a) $N_1 > N_2 > N_3 > N_4$ (b) $N_1 > N_2 > N_4 > N_3$
(c) $N_2 > N_1 > N_4 > N_3$ (d) $N_2 > N_4 > N_3 > N_1$
18. Heaviest nuclide which does not show radioactive nature is:
(a) Bismuth (b) Lead
(c) Technetium (d) Neptunium
19. 1 kg of aqueous urea solution (mole fraction of solute = 0.2) is diluted to 5 kg. Mole fraction of solute in diluted solution is:
(a) 0.2 (b) 4×10^{-2}
(c) 0.029 (d) 0.971
20. Nickel forms a gaseous compound of the formula $\text{Ni}(\text{CO})_x$. What is the value of x if under similar conditions of temperature and pressure, methane effuses 3.24 times faster than the compound? (For Ni, $M = 58.7$)
(a) 3.9 (b) 2.1
(c) 4.7 (d) 3.0
21. Inter – particle distance between Li and H in LiH is 1.596 \AA . Observed dipole moment of LiH is $1.964 \times 10^{-29} \text{ C.m}$. The percentage (%) ionic character in LiH is
(a) 56.0% (b) 90.8%
(c) 76.8% (d) 100%
22. What is the percentage of MgCO_3 in mixture of MgCO_3 and CaCO_3 if its 2g require $2\text{gH}_2\text{SO}_4$ for complete neutralization?
(a) 89% (b) 11%
(c) 50% (d) 25%

23. Sum of oxidation states of all the carbon atoms in toluene molecule is
- (a) -1 (b) $-\frac{7}{8}$
 (c) $-\frac{8}{7}$ (d) -8

24. Oxidation state of oxygen in O_2PtF_6 is
- (a) $-\frac{1}{2}$ (b) -2
 (c) $\frac{1}{2}$ (d) -1

25. When attacked by Br^\bullet , which H-atom will be replaced most readily?



- (a) H_a (b) H_b
 (c) H_c (d) H_d

26. Consider the molecules having formula $C_{10}H_{16}$. Which of the following structural features are not possible within this set of molecules?

- (a) 2 triple bonds (b) 1 ring and 1 triple bond
 (c) 3 double bonds (d) none of these

27. Which metal adsorbs hydrogen to large extent?

- (a) Al (b) Cr
 (c) Pd (d) Zn

28. Among the following the compound which is both paramagnetic and coloured is

- (a) $K_2Cr_2O_7$ (b) $(NH_4)_2[TiCl_6]$
 (c) VO_4 (d) $K_3[Cu(CN)_4]$

29. A mixture of $HCOOH$ and $H_2C_2O_4$ is heated with conc. H_2SO_4 . The gases produced were passed through KOH solution where their volume decreased by $\frac{1}{6}$. Ratio of two acids in the

mixture

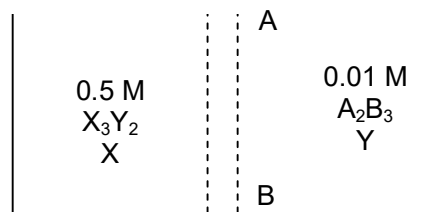
- (a) 1 : 4 (b) 4 : 1
 (c) 1 : 1 (d) data insufficient

30. The correct order of energy levels in H-atom is

- (a) $3s = 3p = 3d > 2s$ (b) $3d > 3p > 3s > 2s$
 (c) $3d > 3p = 3s > 2s$ (d) $3d > 3p > 3s = 2s$

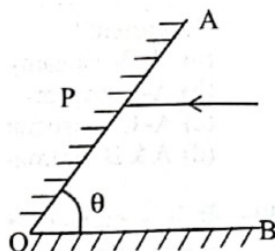
31. X_3Y_2 when reacts with A_2B_3 in aqueous solution, it gives brown colour. These are separated by a semipermeable membrane AB as shown in figure. Assuming that electrolytes are completely ionized in solution then due to osmosis there is

- (a) brown colour formation in side X
 (b) brown colour formation in side Y
 (c) brown colour is formed in both sides X and Y
 (d) no brown colour formation in sides X or Y



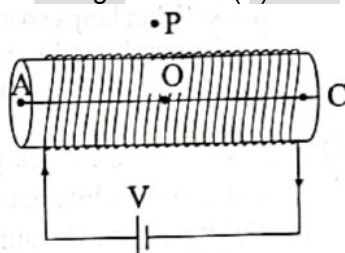
32. One fine morning, Mr. Ravi visited Gandhi park with his grandson. When he was just on a bridge over the lake in the park, an old wooden toy 'just' dropped from his hand. The toy went straight down to hit surface to calm water, then sank into water to a certain depth below water surface and returns back due to upthrust of water to the hands of Mr. Ravi in the same position from where it was dropped. Assuming this position to be at height 19.6 meter above the surface of water, and density of material of toy to be just half the density of water in lake, the total time in which toy is received back to the hand of Mr. Ravi is calculated to be
- (a) 2 second (b) 4 second
(c) 8 second (d) 16 second

33. Two plane mirrors OA and OB are inclined at an angle θ as shown in figure. A ray of light incident parallel to BO strikes the mirror OA at point P. It gets reflected from mirror OA and then reflected from the mirror OB, the ray finally emerges parallel to OA. The value of angle θ is



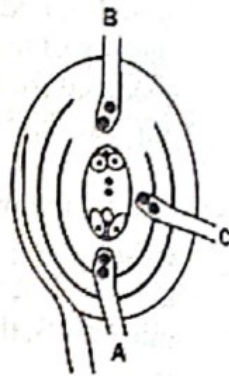
- (a) 90° (b) 60°
(c) 45° (d) 30°

34. A long solenoid of length 2 m and radius 10 cm having 2000 turns per meter carries a current of 1.0 A. The strength of magnetic field (B) is maximum at point

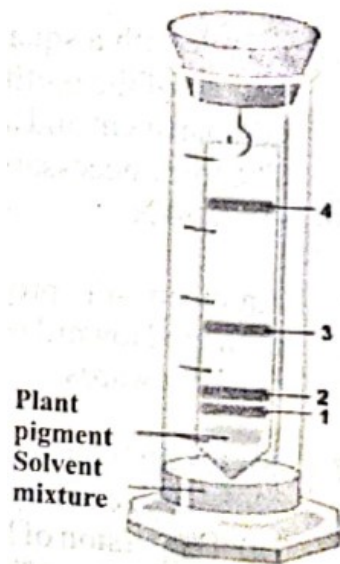


- (a) A at the left end (b) C at the right end
(c) O at the centre of solenoid (d) P outside the solenoid
35. A tank with a square base of area 2.0 meter^2 is divided by a vertical partition in the middle. The bottom of the partition has a small hinged door of area 10 cm^2 . The tank is filled with water in one compartment and a liquid of relative density 1.8 in other compartment, both to a height 5.0 meter. The force necessary to keep the door close is approximately ($g = 9.8 \text{ m/s}^2$)
- (a) 0.04 N (b) 3.9 N
(c) 39 N (d) Zero
36. An electron is projected horizontally towards east in uniform magnetic field B. The electron is deflected towards north by the magnetic field. The magnetic field is directed
- (a) East wards (b) West wards
(c) Upward (d) Downward
37. Sir CV Raman announced the discovery of Raman Effect on February 28, 1928. He received 1930 Nobel Prize in Physics for this discovery. Raman Effect is the discovery of
- (a) Dispersion of light (b) Total Internal Reflection of light
(c) Refraction of light (d) Inelastic scattering of light

38. In nineteenth century, farmers in Japan found that some seedlings of rice became very tall. They called it 'Bakane Disease' or mad seedling disease. All these mad plants were found to be infected by a fungus, *Fusarium moniliforme*. This led to the discovery of a phytohormone, later named.
- (a) Vernalin (b) Auxin
(c) Florigen (d) Gibberellin
39. In most angiosperms, when the ovule is mature, the pollen germinates on stigma, travel through style and ultimately enters the ovule. In the adjacent diagram, three possibilities of pollen tube entry are shown. What do A, B and C represent?



- (a) A – Mesogame, B – Chalazogamy & C – Porogamy
(b) A – Progamy, B – Chalazogamy & C - Mesogamy
(c) A – Chalazogamy, B – Mesogamy & C – Porogamy
(d) A & B – Porogamy, C – Chalazogamy
40. It is a common observation that members of Cucurbitaceae, like bottle – gourd, pumpkin, watermelon, musk melon, etc. have large fruits while their stems are usually not more than a finger thick. What helps so much food to be translocated from leaves to the fruits for storage?
- (a) Intaxylary phloem (b) Sieve-tube with companion cells
(c) Bicollateral vascular bundles (d) Trichomes on internodes
41. In some bird, black plumage gene is dominant over white plumage gene. One black bird was mated with white feathered bird. It resulted in all chicks with blue plumage. Selfing among these blue birds would result in:
- (a) 1 black : 1 white : 2 blue (b) 9 blue : 3 black : 3 white
(c) 1 blue : 1 black : 1 white (d) 3 blue : 1 white
42. The adjacent diagram shows chromatographic separation of plant pigments, extracted from spinach leaves. The sequence of pigment bands from below upwards is:



- (a) Chlorophyll b, Chlorophyll a, Carotenes & Carotenes
- (b) Carotenes, Carotenols, Chlorophyll a & Chlorophyll b
- (c) Chlorophyll a, Chlorophyll b, Carotenes & Carotenols
- (d) Carotenols, Phycobilins, Chlorophyll a & Chlorophyll b

43. A particle of mass 0.3 kg starts moving from rest, in one dimension, under a force that delivers constant power $P = 1.5$ watt. The kinetic energy of the particle will be $KE = 15$ Joule after a time of

- (a) 5 S
- (b) 10 S
- (c) 12 S
- (d) 15 S

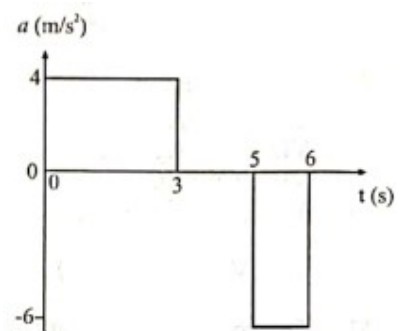
44. A trolley of mass 200 kg carrying a sandbag of mass 20 kg is moving on a frictionless horizontal track with speed 36 kh/hr. After a while, sand starts leaking out of the bag on the floor of trolley at the rate 0.04 kg/sec. What is the speed of trolley after the entire sand bag is empty?

- (a) 8 m/s
- (b) 9.2 m/s
- (c) 10 m/s
- (d) 10.5 m/s

45. A particle, initially at rest at origin, starts moving under acceleration a along + x direction. The acceleration versus time graph is shown in figure.

The displacement and the velocity of the particle after 6 second are

- (a) 51 meter, 6 m/s
- (b) 33 meter, 6 m/s
- (c) 42 meter, 18 m/s
- (d) 27 meter, 24 m/s



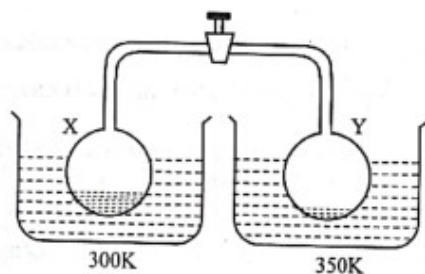
46. Gravitational potential energy of a system of two particles of masses m_1 and m_2 , separated by distance r , is given by $U = -\frac{Gm_1m_2}{r}$, where G is the universal Gravitational constant.

Consider two stars, each of mass M , initially separated by distance d and at rest with respect to each other. The two stars start moving towards each other under their mutual gravitational attraction. The stars can be treated as point objects and motion is assumed non-relativistic. As measured from the laboratory frame, the speed of each star when they are at a distance $\frac{d}{2}$ apart from each other is

(a) $\sqrt{\frac{GM}{d}}$
(c) $\sqrt{\frac{GM}{2d}}$

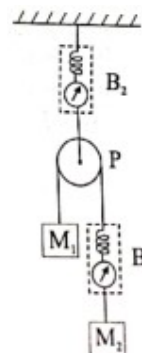
(b) $\sqrt{\frac{2GM}{d}}$
(d) $\sqrt{\frac{GM}{4d}}$

47. An engine approaches a vertical cliff with constant speed 72 km/hour. When the engine is at a distance of 0.7 km from the cliff, it blows a whistle. The driver hears the echo after a time (Speed of sound in air is 330 m/s.)
(a) 3.88 S (b) 4.00 S
(c) 4.12 S (d) 4.24 S
48. A vessel contains a liquid-1 of density 0.8 gm/cm³ over a liquid-2 of density 13.6 gm/cm³. The two liquids are immiscible. A homogeneous solid sphere with half of its volume immersed in liquid-1 and other half in liquid-2. The density of the material of the sphere in gm/cm³ is
(a) 3.3 (b) 6.4
(c) 7.2 (d) 12.8
49. Amphoteric nature of Al₂O₃ is employed in which of the following process/es?
(a) Bayer's process (b) Hall's process
(c) Serpek's process (d) Dow's process
50. As a general trend the First Ionization Energy (IE₁) of elements decreases on moving down in a group in the periodic table. Keeping the observation in mind select the correct order of elements with respect to their IE₁
I. Li > Na > K > Rb > Cs > Fr
II. Li > Na > K > Rb > Cs < Fr
III. Sr < Ba > Ra
IV. Sr > Ba < Ra
V. Cu > Ag > Au
VI. Cu > Ag < Au
VII. Cd > Hg
VIII. Cd < Hg
(a) I, V, VII (b) II, IV, VIII
(c) III, V, VII (d) II, VI, VIII
51. Two containers each containing water in liquid state are connected by a valve as shown in diagram



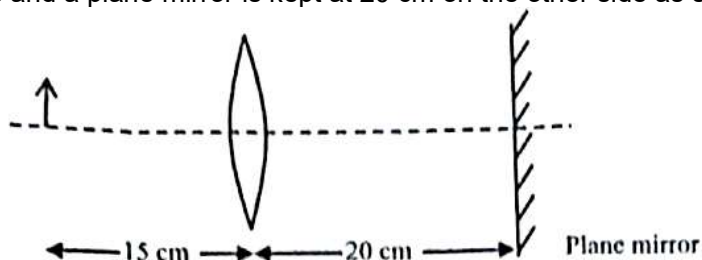
- Given that vapour pressure of water at 300 K and 350 K are 22 torr and 40 torr, select correct statement(s):
(a) The final pressure in each container after the valve is opened, while keeping the containers at their respective temperatures, is equal but more than 22 torr.
(b) The final pressure in each container after the valve is opened, while keeping the containers at their respective temperatures, is 40 torr.
(c) Mass of water is decreased in container X.
(d) Mass of water is decreased in container Y.

52. Two blocks M_1 and M_2 of mass 3 kg and 6 kg respectively are connected through a string and spring balance B_1 . The string passes over a massless and frictionless pulley P . The pulley is suspended from a rigid support through spring balance B_2 . Strings are massless and inextensible. Masses of spring balances are negligible. The system is released from rest. At the instant when masses M_1 and M_2 are moving with same speed ($g = 9.8 \text{ m/sec}^2$)



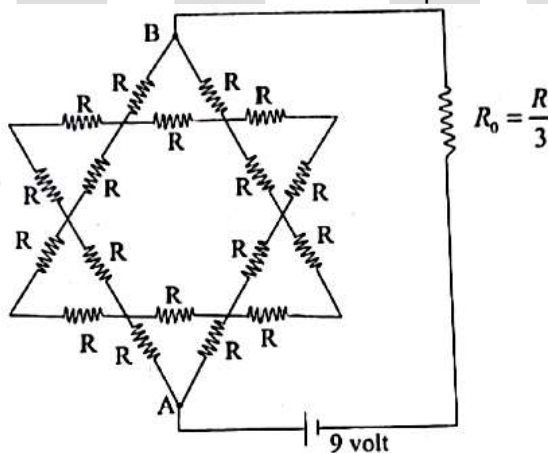
- (a) reading of B_1 is 4.5 kg wt. (b) reading of B_1 is 4.0 kg wt.
 (c) reading of B_2 is 9.8 kg wt. (d) acceleration of M_1 is $\frac{9.8}{3} \text{ mS}^{-2}$

53. Focal length of a thin convex lens is 10 cm. An object is placed at a distance 15 cm in front of the lens and a plane mirror is kept at 20 cm on the other side as shown in figure.



- (a) The final image is formed at distance 10 cm from lens towards the mirror
 (b) The final image is formed at a distance 30 cm from lens means 10 cm behind the mirror
 (c) The final image has magnification $m = -2$
 (d) The final image has magnification $m = +2$

54. Given network of 18 resistors, each equal to $R = 3 \text{ ohm}$, is connected in series with resistor R_0 to a source of emf = 9 volt. Choose the correct option.



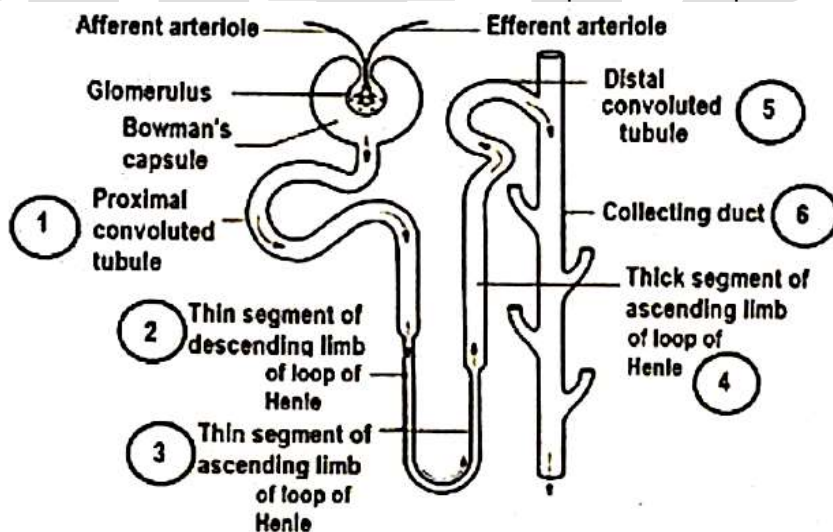
- (a) Current drawn from battery is 1.5 A
 (b) Potential difference between A and B is 7.5 V
 (c) Electrical power dissipated in R_0 is 2.25 watt
 (d) Electrical power dissipated in network between A and B is 12.25 watt.

55. Two bodies of masses $m_1 = 2 \text{ kg}$ and $m_2 = 1 \text{ kg}$ are moving towards each other in the same straight line with speed 12 m/s and 6 m/s respectively as shown in figure. The bodies can be assumed point masses. After some time, the two bodies undergo elastic collision. After the collision



- (a) the two bodies nearly exchange their velocities

- (b) m_1 comes to rest
 (c) m_2 moves with speed 18 m/s towards right
 (d) m_1 and m_2 move with same speeds but they reverse their directions of motion
56. Which of the following evolutionary lineages of man can be categorized under pre-historic man?
 (a) Ramapithecus (b) Homo habilis
 (c) Homo sapiens fossilis (d) Homo heidelbergensis
57. Select the set of diseases caused by deficiency of B-Complex Vitamins:
 (a) Beri-Beri & Pelagra (b) Dermatitis & Wernicke-Korsakoff Syndrome
 (c) Cheilosis & Pernicious anaemia (d) Marasmus & Kwashiorkor
58. After rainy season, a Biology teacher took the students on a plant collection tour. From a pond, they collected a beaker of water with aquatic plants in it. The students are likely to find which of the following organisms in it?
 (a) Spirogyra, Azolla, Riccia fluitans & Cosmarium
 (b) Ulothrix, Chlorella, Chara & Ricciocarpus natans
 (c) Marchantia, Funaria, Lycopodium & Gnetum
 (d) Salvinia molesta, Azolla, Chlorella & Cladophora
59. Various parts of mammalian uriniferous tubules (nephrons), play an important role in Urine formation through processes like ultrafiltration, selective reabsorption by active transport, reabsorption by passive osmosis and secretion. While the filtrate flows through different parts of the uriniferous tubules (**Numbered 1 – 6 in the diagram given below**), not only its volume is reduced but its composition is also considerably changed, due to exchange of materials between the filtrate and the blood of the peritubular capillaries.



- From among the **numbered parts (1 – 6)** in the above diagram, the options are given in a manner that they highlight two aspects separately, i.e, part(s) having columnar epithelial cells with 'brush border', suitable for reabsorption and those parts completely or poorly permeable to water. Select-out the desired options:
- (a) 4, 5 (b) 1
 (c) 2, 3 (d) 2, 3, 6
60. The 0.01 M NH_4Cl solution at 25°C has:
 (a) $[\text{Cl}^-_{\text{aq}}] < 10^{-2}\text{M}$ (b) $[\text{NH}^+_{4\text{aq}}] < 10^{-2}\text{M}$
 (c) $\text{pOH} > 7$ (d) $[\text{H}^+] > 10^{-7}\text{M}$