



NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE

(NSEJS) 2022-2023

conducted jointly by

HOMI BHABHA CENTRE FOR SCIENCE EDUCATION (HBCSE-TIFR)

QUESTIONS & SOLUTIONS

Sunday, November 27, 2022 | Time: 2 Hours | Max. Marks : 216 | QUESTION CODE : 54

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INSTRUCTIONS

Write the question paper code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated, Note that the same Question paper code appears on each page of the question paper.

INSTRUCTIONS TO CANDIDATES

1. Use of mobile phone, smart watches, and iPad during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR sheet. make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.

Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.

4. On the OMR Answer sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling bubbles.
5. Your **Ten-digit roll number and date of birth** entered in the OMR Answer sheet shall remain your login credentials means login id and password respectively for accessing your performance/ result in NSEJS-2022.
6. Question paper has two parts. In part A1 (Q. No.1 to 48) each question has four alternatives, out of which only one is correct. Choose the correct alternative (s) and fill the appropriate bubbles(s), as shown.

Q.No.12



In part A2 (Q.No. 49 to 60) each question has four alternative out of which any number of alternative(s)(1,2,3 or 4 may be correct. You have to choose all correct alternative(s) and fill the appropriate bubbles(s). as shown.

Q.No.52



7. For **Part A1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer In **Part A2**, you get 6 marks. If all the correct alternative are marked. No Negative marks in this part.
8. Rough work should be done only in the space provided. There are **12** printed pages in this paper.
9. Use calculator is not allowed
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting answer paper, take away the question paper & candidate's copy of OMR for your reference

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR answer sheet.

OMR answer sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED, Scratching or overwriting may result in wrong score.

DO NOT WRITE ON THE BACK SIDE OF THE OMR ANSWER SHEET.

Question Paper Code: 54

INDIAN ASSOCIATION OF PHYSICS TEACHERS

NATIONAL STANDARD EXAMINATION IN JUNIOR SCIENCE (NSEJS-2022)

Time : : 120 minute

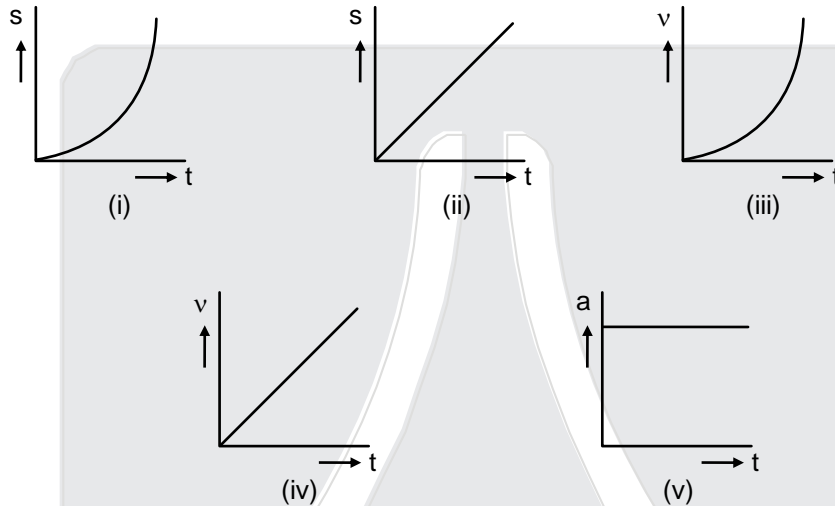
Max. Marks : 216

Attempt All Sixty Questions

Part-A1

ONLY ONE OUT OF FOUR OPTIONS IS CORRECT BUBBLE THE CORRECT OPTION.

1. Figures (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.



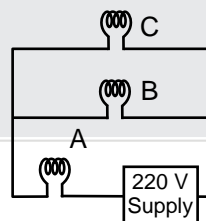
Which of the above graphs represent uniform motion?

- (a) (i) only (b) (ii) only (c) (i) (iv) and (v) (d) (iv) and (v)

Ans. (b)

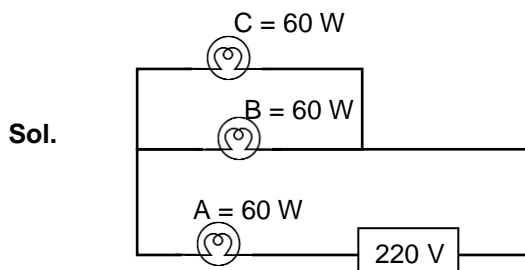
Sol. Figure (ii) is the correct answer graph between s and t in straight line which represent uniform velocity.

2. Three identical electric bulbs A, B and C having specification 60 W, 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

Ans. (d)

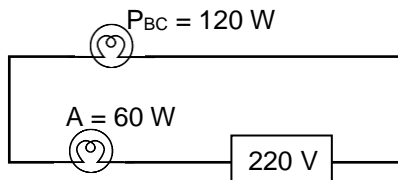


Now bulb B and C are connected in parallel

So, $(P_{eq})_{BC} = P_B + P_C = 60 + 60 = 120$ watt

Now, redraw the circuit

Now, bulb A and equivalent of bulb (B & C) are connected in series.



$$\text{So, } \frac{1}{P_{eq}} = \frac{1}{120} + \frac{1}{60}$$

$$\frac{1}{P_{eq}} = \frac{1+2}{120}$$

$$\frac{1}{P_{eq}} = \frac{3}{120}$$

$$P_{eq} = \frac{120}{3}$$

$$P_{eq} = 40 \text{ Watt}$$

So total Power dissipated in three bulb is = 40 Watt

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%

Ans.
Sol.

$$r' = r - 0.15\%r$$

$$= r - \frac{0.15r}{100}$$

$$= \frac{100r - 0.15r}{100}$$

$$= \frac{99.85r}{100}$$

$$R = \frac{\rho l}{A} \Rightarrow A = \pi r^2$$

$$R' = \frac{\rho l'}{A'} \Rightarrow A' = \pi r'^2$$

$$A' = \pi \left(\frac{99.85r}{100} \right)^2$$

$$A' = \pi r^2 \cdot \frac{99.85 \times 99.85}{100 \times 100}$$

$$A' = \frac{99.85 \times 99.85}{100 \times 100} A \quad \dots(1)$$

$$V' = V$$

$$A'l' = Al$$

$$\frac{99.85 \times 99.85}{100 \times 100} A \times l' = Al$$

$$l' = \frac{100 \times 100}{99.85 \times 99.85} l \quad \dots(2)$$

$$R' = \frac{\rho l'}{A'}$$

$$R' = \frac{\rho \cdot \frac{100 \times 100}{99.85 \times 99.85} l}{\frac{99.85 \times 99.85}{99.85 \times 99.85} A}$$

$$R' = \frac{\rho l}{A} \cdot \frac{100 \times 100 \times 100 \times 100}{99.85 \times 99.85 \times 99.85 \times 99.85}$$

$$R' = R \times 1.006$$

$$\frac{\Delta R}{R} \times 100\% = \frac{R' - R}{R} = \frac{1.006R - R}{R} \times 100$$

$$= 0.006 \times 100 = 0.6\%$$

OR

We know that Resistance $R = \frac{\rho l}{A}$

Now volume remain constant.

$$\text{So } R = \frac{\rho l}{A} \times \frac{V}{v} \quad [\because V = Al]$$

$$R \propto \frac{1}{r^4} \quad [A = \pi r^2]$$

$$\frac{\Delta R}{R} = \frac{-\Delta r}{r} \times 4$$

$$\frac{\Delta R}{R} = -(-0.15) \times 4 \Rightarrow \frac{\Delta R}{R} = 0.6\%$$

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 273 K 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%

Ans. (b)

Sol. $V_{rms} = \sqrt{\frac{\gamma RT}{m}}$

$$V \propto \sqrt{T}$$

$$\text{Now } V_t = V_o + 0.61t$$

at 0°C

$$V_t = 332$$

at 27°C

$$V_t = V_o + 0.61t \text{ (Where } t \text{ is in } ^\circ\text{C)}$$

$$= 332 + 0.61 \times 27$$

$$= 348.47 \text{ m/sec.}$$

$$= \frac{352 - 348.47}{352} \times 100 = 1\%$$

5. In some plants and fungi, some organelles are found which convert lipids to sugar in early stages of oil seed's germination. What are these ?

- (a) Glyoxysomes (b) Lysosomes (c) Ribosomes (d) Liposomes

Ans. (a)

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

Ans. (b)

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 – 5.8 (b) 6.5 – 7.5 (c) 7.5 – 8.5 (d) Above 9.0

Ans. (b)

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

Ans. (c)

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

Ans. (c)

10. In the following EMP pathway, enzymes catalyzing the reactions are numbered E₁ to E₁₀. At which enzyme levels, ATPs are generated at substrate level ?

Glucose $\xrightarrow{E_1}$ Glucose-6-phosphate $\xrightarrow{E_2}$ Fructose-6-phosphate $\xrightarrow{E_3}$ Fructose 1, 6 Diphosphate $\xrightarrow{E_4}$ Dihydroxyacetone Phos. $\xrightarrow{E_5}$ 3 Phosphoglyceraldehyde $\xrightarrow{E_6}$ 1, 3 Diphosphoglyceraldehyde $\xrightarrow{E_7}$ 3 Phosphoglyceric Acid $\xrightarrow{E_8}$ 2 Phosphoglyceric Acid $\xrightarrow{E_9}$ Phosphoenol pyruvic Acid $\xrightarrow{E_{10}}$ Pyruvic Acid.

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

Ans. (c)

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 striatum (d) Corpus callosum

Ans. (d)

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

Ans. (a)

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

Ans. (c)

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

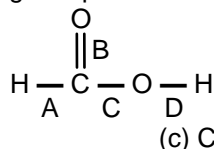
Ans. (c)

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

Ans. (a)

16. Which bond will break when following compound is dissolved in water ?



- (a) A (b) B (c) C (d) D

Ans. (d)

Sol. It is an acid, when dissolved in water then produce H^+ ion from the O–H bond

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) $N_2 > N_4 > N_3 > N_1$

Ans. (c)

18. Heaviest nuclide which does not show radioactive nature is :

- (a) Bismuth (b) Lead (c) Technetium (d) Neptunium

Ans. (b)

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

Ans. (c)

Sol. Molar mass of urea is 60g/mol. 1 mole of solution will contain 0.2 mole of urea and 0.8 mole of water. This corresponds 12g urea and 14.4 g water.

$$\text{Thus 1000 g of urea solution will contain} = \frac{12 \times 1000}{26.4} = 454.54 \text{ g. Urea.}$$

$$= \frac{454.54}{60} = 7.57 \text{ mole of Urea.}$$

$$\text{The mass of water in diluted solution} = 5000 - 454.54 = 4545.46 \text{ g}$$

$$\text{Mole of water} = \frac{4545.46}{18} = 252.52 \text{ mole}$$

Mole fraction of urea in diluted solution

$$= \frac{7.57}{252.52 + 7.57} = 0.0291$$

20. Nickel forms a gaseous compound of the formula $\text{Ni}(\text{CO})_x$. What is the value of x if under similar condition 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

Ans. (a)

Sol. $r \propto \sqrt{\frac{1}{M_w}}$

$$\text{Given } r_{\text{CH}_4} = r_{\text{Ni}(\text{CO})_x} \times 3.24$$

$$\frac{r_{\text{CH}_4}}{r_{\text{Ni}(\text{CO})_x}} = \sqrt{\frac{M_w \text{Ni}(\text{CO})_x}{M_w \text{CH}_4}}$$

$$\frac{r_{\text{Ni}(\text{CO})_4} \times 3.24}{r_{\text{Ni}(\text{CO})_4}} = \sqrt{\frac{M_w \text{Ni}(\text{CO})_x}{M_w \text{CH}_4}}$$

$$3.24 = \sqrt{\frac{M_w \text{Ni}(\text{CO})_x}{16}}$$

$$(3.24)^2 = \frac{M_w \text{Ni}(\text{CO})_x}{16}$$

$$M_w \text{Ni}(\text{CO})_x = 3.24 \times 3.24 \times 16 = 167.9616$$

$$M_{wNi(CO)_x} = 58 + 28x$$

$$58 + 28x = 167.9616$$

$$28x = 167.9616 - 58$$

$$28x = 109.9616$$

$$x = \frac{109.9616}{28}$$

$$x = 3.9272$$

21. Inter-particle distance between Li and H in LiH is 1.596 Å. Observed dipole moment of LiH is 1.964×10^{-29} C.m. The percentage (%) ionic character in LiH is
 (a) 56.0% (b) 90.8% (c) 76.8% (d) 100%

Ans. (c)

Sol. The observed dipole moment = 1.964×10^{-29} C.m.

Theoretical dipole moment = 1 electronic charge \times interatomic distance

$$= 1.602 \times 10^{-19} \times 1.596 \times 10^{-10} \text{ C.m.} = 2.556792 \times 10^{-29} \text{ C.m.}$$

Now the fraction of observed dipole moment to theoretical dipole moment will give us the volume of percentage ionic character of LiH

$$\frac{\text{observed dipole moment}}{\text{Theoretical dipole moment}} \times 100 = \frac{1.964 \times 10^{-29} \text{ C.m.}}{2.556792 \times 10^{-29} \text{ C.m.}} \times 100$$

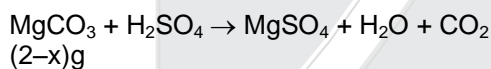
$$= 0.768 \times 100 = 76.8\%$$

22. What is the percentage of $MgCO_3$ in a mixture of $MgCO_3$ and $CaCO_3$ if its 2g require 2g H_2SO_4 for complete neutralization?
 (a) 89% (b) 11% (c) 50% (d) 25%

Ans. (b)

Sol. $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$
 'x'g

$$\text{Mole of } CaCO_3 \left(\frac{x}{100} \right)$$



$$\text{Mole of } MgCO_3 = \frac{2-x}{84}$$

$$\frac{x}{100} + \frac{2-x}{84} = \frac{2}{98}$$

$$\frac{84x + 200 - 100x}{100 \times 84} = \frac{2}{98}$$

$$200 - 16x = \frac{2}{98} \times 100 \times 84 = 171.42$$

$$16x = 28.57$$

$$x = 1.78$$

Amount of $MgCO_3$ is = 2-x

$$= 2 - 1.78$$

$$= 0.22g$$

$$\% \text{ composition of } MgCO_3 = \frac{0.22}{2} \times 100$$

$$= 11\%$$

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

Ans. (d)

Sol. Given : $C_6H_5-CH_3$

To find : Sum of oxidation states of all C atom in $C_6H_5CH_3$

Oxidation state (C) = $7x + 8 = 0$

$$x = \frac{-8}{7}$$

Total 'C' atoms are 7.

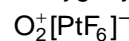
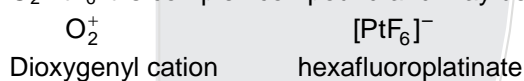
So, sum of oxidation state of 7 carbon atoms = $\frac{-8}{7} \times 7 = -8$

24. Oxidation state of oxygen in O_2PtF_6 is:

- (a) $-\frac{1}{2}$ (b) -2 (c) $\frac{1}{2}$ (d) -1

Ans. (c)

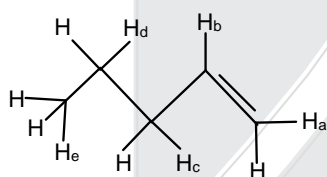
Sol. O_2PtF_6 it is complex compound and may be written as.



$$2x = +1$$

$$x = +\frac{1}{2}$$

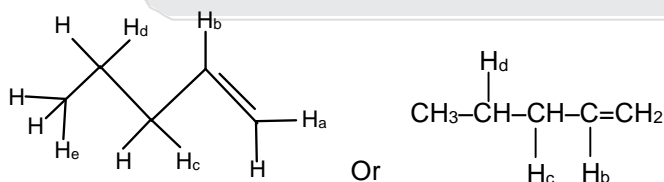
25. When attacked by Br, which H-atom will be replaced most readily?



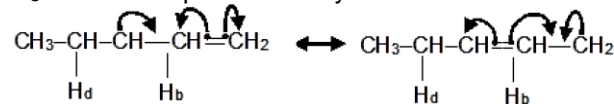
- (a) H_a (b) H_b (c) H_c (d) H_d

Ans. (c)

Sol.



H_c atom will be replaced readily because it is due to Resonance



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

Ans. (a)

27. Which metal adsorbs hydrogen to large extent?
(a) Al (b) Cr (c) Pd (d) Zn

Ans. (c)

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) $VOSO_4$ (d) $K_3[Cu(CN)_4]$

Ans. (c)

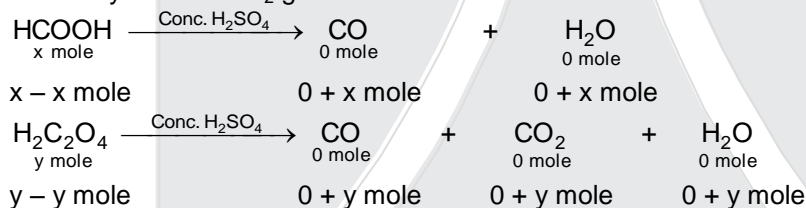
Sol. In $K_2Cr_2O_7$, the Cr is in +6 oxidation state.
Electronic configuration of $Cr^{+6} 3d^0$
In $(NH_4)_2[TiCl_6]$, the Ti is +4 oxidation state.
Electronic configuration of $Ti^{+4} = 3d^0$
In $VOSO_4$, V is in +4 oxidation state.
Electronic configuration of $V^{+4} = 3d^1$
It contains 1 unpaired electron.
 $K_3[Cu(CN)_4] \rightarrow Cu^+ : 3d^{10}$
 $VOSO_4$, due to the presence of one unpaired electron, is paramagnetic and coloured.
Hence, option C is the answer

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

Ans. (b)

Sol. Let x mole of $HCOOH$ and y mole of $H_2C_2O_4$ react with conc. H_2SO_4 then it produces (x+y) mole of CO and y mole of CO_2 gas.



Total moles of gas produced = (x + 2y) mole

Mole of CO_2 observed by KOH = y mole

According to question : $\frac{y}{x + 2y} = \frac{1}{6}$

$x + 2y = 6y$

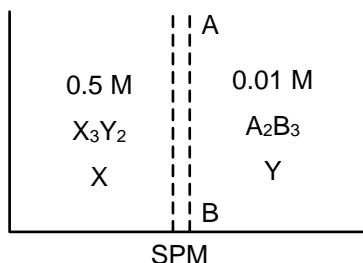
$x = 4y$

$HCOOH : H_2C_2O_4 :: 4 : 1$

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) $3d > 3p > 3s = 2s$

Ans. (a)

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

Ans. (d)

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 of 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

Ans. (c)

Sol.

Acceleration of block in upward direction

$$= \frac{vdg}{2 \text{ mass of block}} = \frac{vdg}{2 \frac{d}{2} v}$$

$$= g \text{ upwards}$$

volume of toy is V

$$B = Vd_w g = vdg$$

wt. of toy = $\frac{vd}{2} g$
 net force on toy

$$f = vdg - V \frac{d}{2} g \text{ upwards}$$

On surface of water speed,

$$V_2 = 0 + 2 \times g \times 19.6$$

$$V = 19.6 \text{ m/s.}$$

time taken upto water surface

$$19.6 = 0 + 9.8 t$$

$$t = 2 \text{ sec.}$$

Return time from surface to his hand = 2sec.

down word Acceleration $F = mg \rightarrow B$

$$a = \frac{F}{\text{mass of toy}}$$

$$a = \frac{mg - B}{m} = \frac{v \frac{d}{2} g - vdg}{v \frac{d}{2}} = g$$

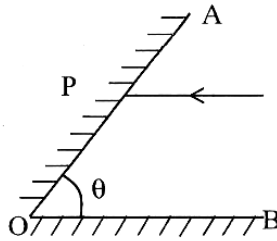
time taken in side water when its velocity become zero

$$0 = 19.6 - 9.8 t$$

$$t = 2 \text{ sec.}$$

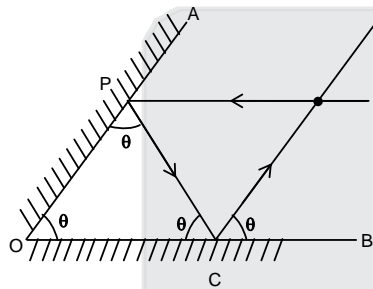
$$\text{total time} = 2 + 2 + 2 + 2 = 8 \text{ sec.}$$

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



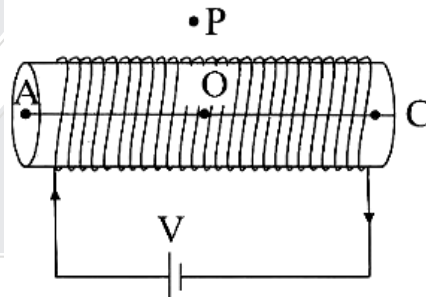
- (a) 90° (b) 60° (c) 45° (d) 30°
- Ans. (b)

Sol.



In $\triangle OCP$,
 $\theta + \theta + \theta = 180^\circ$
 $\theta = 180^\circ / 3$
 $\theta = 60^\circ$

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 solenoids
- Ans. (c)

Sol. O at the centre of solenoid the strength of magnetic field is maximum.

35. A tank with a square base of area 2.0 meter² is divided by a vertical partition in the middle. The bottom of the partition has a small hinged door of area 10 cm². 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
- Ans. (c)

Sol. $P_w = \rho gh = 10^3 \times 3 \times 9.8 = 49,000$
 for $P_a = 1.8 \times 10^3$
 $P_a = \frac{1.8}{10} \times 10^3 \times 5 \times \frac{9.8}{10}$
 $= 88200$

$$P = \frac{F}{A}$$

$$F = P \times A = 10 \times 10^{-4} \times 39200$$

$$= \frac{10 \times 39200}{10^4}$$

$$= 39.2 \text{ N}$$

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

Ans. (c)

Sol. Use right hand palm rule to find direction of magnetic field. electron always move opposite to the direction of flow of current.

37. Sir CV Raman announced the discovery of Raman Effect on February 28, 1928. He received 1930 Noble 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

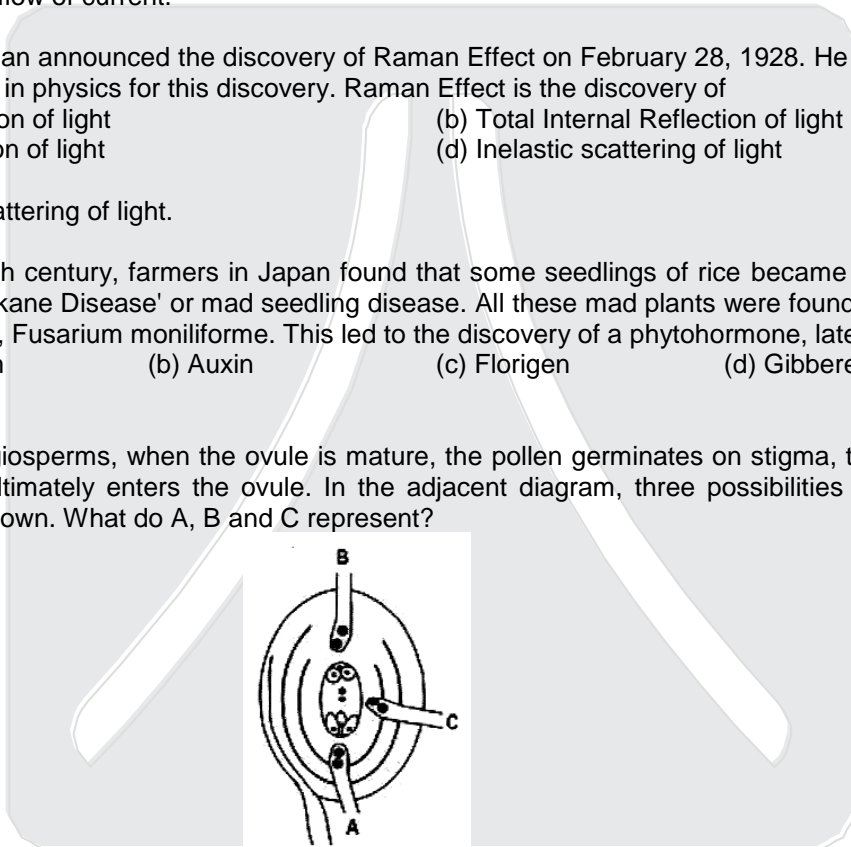
Ans. (d)

Sol. 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) Vernalim (b) Auxin (c) Florigen (d) Gibberellin

Ans. (d)

39. In most angiosperms, when the ovule is mature, the pollen germinates on stigma, travels 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 - Mesogamy, B - Chalazogamy & C - Porogamy
 (b) A - Porogamy, B - Chalazogamy & C - Mesogamy
 (c) A - Chalazogamy, B - Mesogamy & C - Porogamy
 (d) A & B - Porogamy, C - Chalazogamy

Ans. (b)

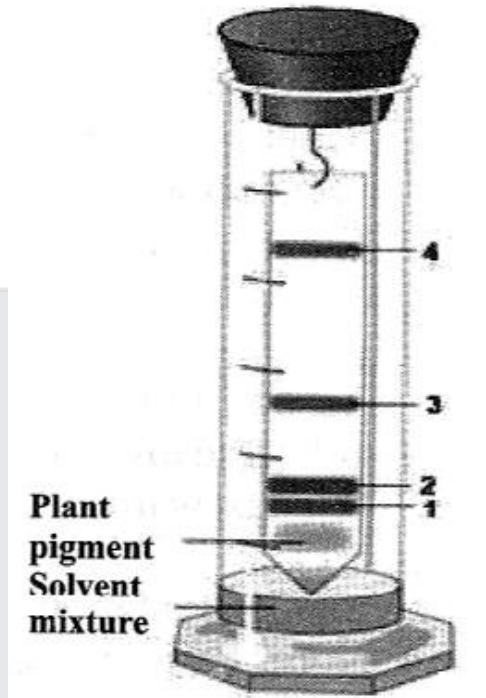
40. It is a common observation that members of Cucurbitaceae, like bottle- gourd, pumpkin, watermelon, musk melon, etc, have large fruits while their stems are usually not more than a finger thick. What helps so much food to be translocated from leaves to the fruits for storage?
 (a) Intraxylary phloem (b) Sieve-tubes with companion cells
 (c) Bicollateral vascular bundles (d) Trichomes on internodes

Ans. (c)

41. In some birds, 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

Ans. (a)

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

Ans. (a)

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

Ans. (b)

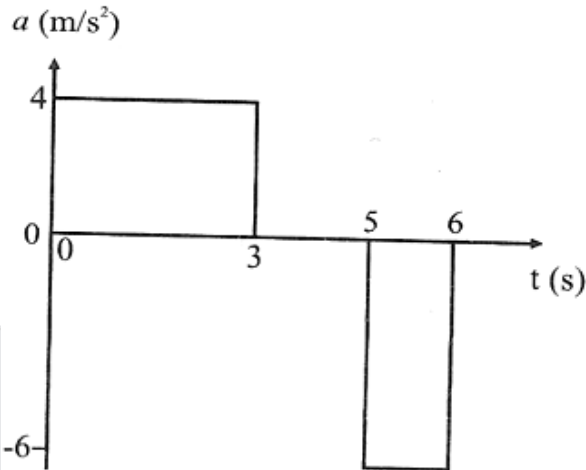
Sol. $P = \frac{W}{t}$
 $W = P \times t$
 Work energy theorem,
 $W = \Delta KE$
 $Pt = k_f - k_i$
 $t = \frac{15 - 0}{1.5} = 10 \text{ sec.}$

44. A trolley of mass 200 kg carrying a sandbag of mass 20 kg is moving on a frictionless horizontal track with speed 36 km/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) 10.8 m/s

Ans. (c)

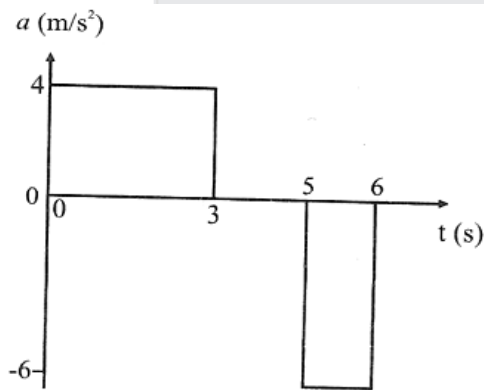
Sol. Initially $V = 36 \text{ km/hr}$
 $V = 10 \text{ m/s}$
 $F_{\text{net}} = 0$
 Leaking of sand from sand bag will not exert any external force on the system.
 Momentum should be conserved speed of trolley after the bag is empty = 36 km/hr or 10m/s

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

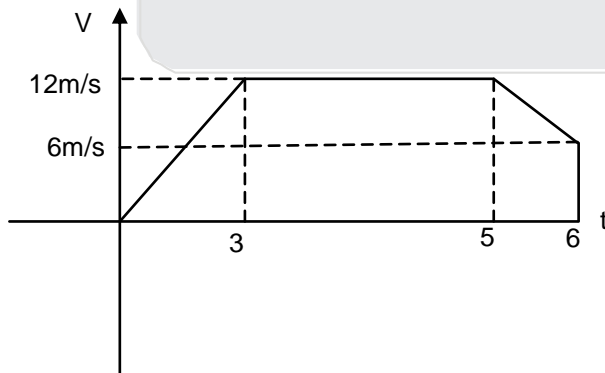


- (a) 51 meter, 6 m/s (b) 33 meter, 6 m/s (c) 42 meter, 18 m/s (d) 27 meter, 24 m/s

Ans.
Sol.



Area under the $a - t$ graph gives velocity
 $V = 4 \times 3 + 0 + 1 \times (-6)$
 $= 6 \text{ m/s}$



Area under the $v - t$ graph gives displacement

$$S = \left(\frac{1}{2} \times 3 \times 12 \right) + (2 \times 12) + \left(\frac{6+12}{2} \times 1 \right)$$

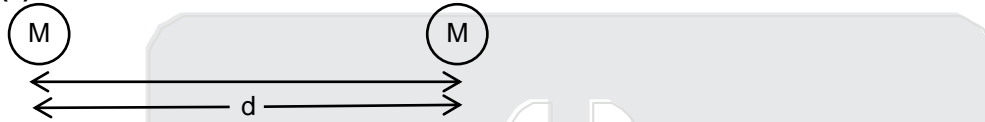
$$= 18 + 24 + 9 = 51 \text{ m}$$

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

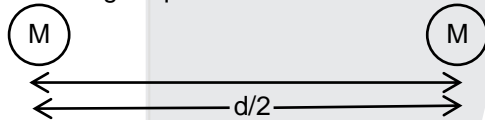
- (a) $\sqrt{\frac{GM}{d}}$ (b) $\sqrt{\frac{2GM}{d}}$ (c) $\sqrt{\frac{GM}{2d}}$ (d) $\sqrt{\frac{GM}{4d}}$

Ans. (a)

Sol.



According to question



By applying the law of energy conservation

$$U_i + K_i = U_f + K_f$$

$$-\frac{GMM}{d} + 0 = -\frac{GMM}{d/2} + 2 \cdot \frac{1}{2} MV^2$$

By solving the above equation

$$V_{\text{star}} = \sqrt{\frac{GM}{d}}$$

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

Ans. (b)

Sol.



$$V = \frac{d}{t}$$

$$t = \frac{700 + 700 - 20t}{330}$$

$$33t = 140 - 2t$$

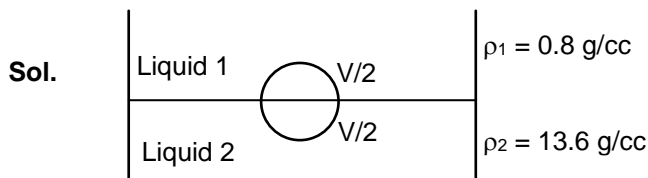
$$35t = 140$$

$$t = \frac{140}{35} = 4 \text{ Sec.}$$

48. A vessel contains a liquid-1 of density 0.8 gm/cm^3 over a liquid-2 of density 13.6 gm/cm^3 . The two liquids are immiscible. A homogeneous solid sphere floats 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/cm^3 is

- (a) 3.3 (b) 6.4 (c) 7.2 (d) 12.8

Ans. (c)



Weight of body = up thrust

$$mg = \rho_1 g \frac{V}{2} + \rho_2 g \frac{V}{2}$$

$$\rho_s V = 1 \times \frac{V}{2} + 13.6 \times \frac{V}{2}$$

$$= 0.4 + 6.8 = 7.2 \text{ g/cc}$$

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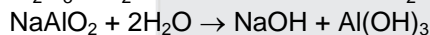
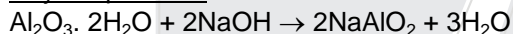
Part –A2

**ANY NUMBER OF OPTIONS 4,3,2, OR 1 MAY BE CORRECT
MARKS WILL BE AWARDED ONLY IF ALL THE CORRECT OPTIONS ARE BUBBLED.**

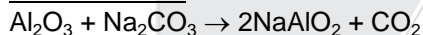
49. Amphoteric nature of Al_2O_3 is employed in which of the following process/es?
(a) Bayer's process (b) Hall's process (c) Serpeck's process (d) Dow's process

Ans. (a, b)

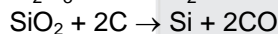
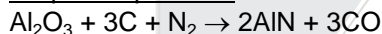
Sol. Bayer's process:



Hall's Process:



Serpeck's process:



50. As a general trend the First Ionization Energy (I.E.₁) of elements decreases on moving down in group in the periodic table. Keeping the observation in mind select the correct order of element with respect to their IE₁

I. $\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs} > \text{Fr}$

II. $\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs} < \text{Fr}$

III. $\text{Sr} < \text{Ba} > \text{Ra}$

IV. $\text{Sr} > \text{Ba} < \text{Ra}$

V. $\text{Cu} > \text{Ag} > \text{Au}$

VI. $\text{Cu} > \text{Ag} < \text{Au}$

VII. $\text{Cd} > \text{Hg}$

VIII. $\text{Cd} < \text{Hg}$

- (a) I, V, VII (b) II, IV, VIII (c) III, V, VII (d) II, VI, VIII

Ans. (Bonus)

Sol. According to the data given in NCERT, correct order of I.E.₁ values.

All ionization energy are in KJ/mol)

$\text{Cd} < \text{Hg}$ (VIII)
876 1007

$\text{Cu} > \text{Ag} < \text{Au}$ (VI)
745 731 889

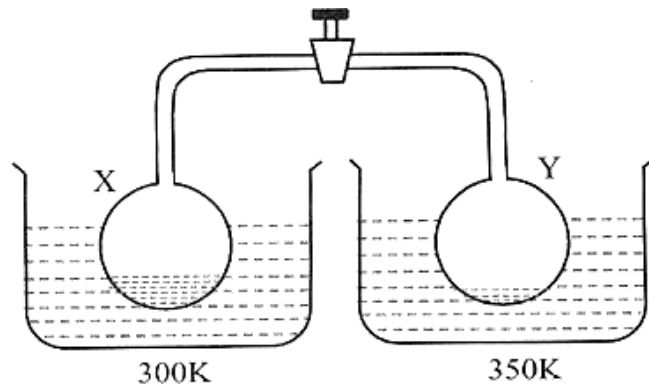
$\text{Sr} > \text{Ba} < \text{Ra}$ (IV)
549 503 509

$\text{Li} > \text{Na} > \text{K} > \text{Rb} > \text{Cs} > \text{Fr}$ (I)
520 496 419 403 376 375

No correct option given, as per NCERT XIth Class unit 10.

So correct options should be I, IV, VI, VIII.

51. Two containers each containing water in liquid state are connected by a valve as shown in diagram.

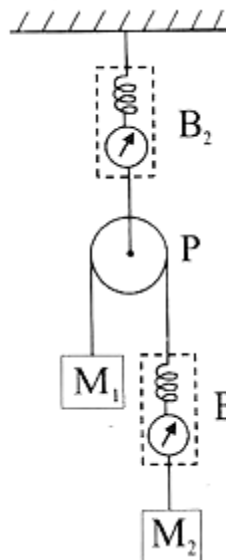


Given that vapour pressure of water at 300 K and 350 K are 22 torr and 40 torr, select correction statement(s):

- (a) The final pressure in each container after the valve is opened, while keeping the containers 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 their respective temperatures, is 40 torr.
- (c) Mass of water is decreased in container X.
- (d) Mass of water is decreased in container Y.

Ans. (d)

52. Two blocks M_1 and M_2 of masses 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 $\frac{9.8}{3} \text{ mS}^{-2}$

Ans. (b, d)

Sol.
$$T_1 = \frac{2m_1m_2}{m_1 + m_2}g$$

$$= \frac{2 \times 3 \times 6}{9} \times 9.8$$

$$= T_1 = 4 \times 9.8$$

$$= T_2 = 2T_1 = 8 \times 9.8$$

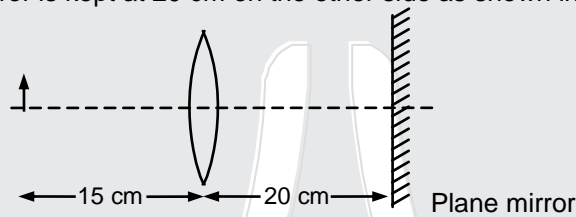
Acceleration

$$a = \frac{m_1 - m_2}{m_1 + m_2} g$$

$$= \frac{6 - 3}{9} \times 9.8$$

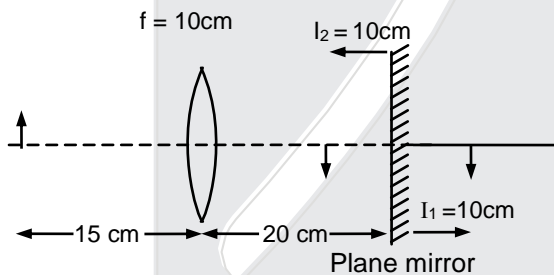
$$= \frac{9.8}{3} \text{ m/sec}^2$$

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 $m = +2$

Ans.
Sol.



For lens

$$u = -15, f = +10 \text{ cm}$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{10} = \frac{1}{v} - \frac{1}{-15}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30}$$

$$\text{or } v = \frac{1}{\frac{1}{30}} \text{ or } v = 30 \text{ equal}$$

for I_1 will behave as virtual object for point mirror $u = +10 \text{ cm}$

$$v = -10 \text{ cm}$$

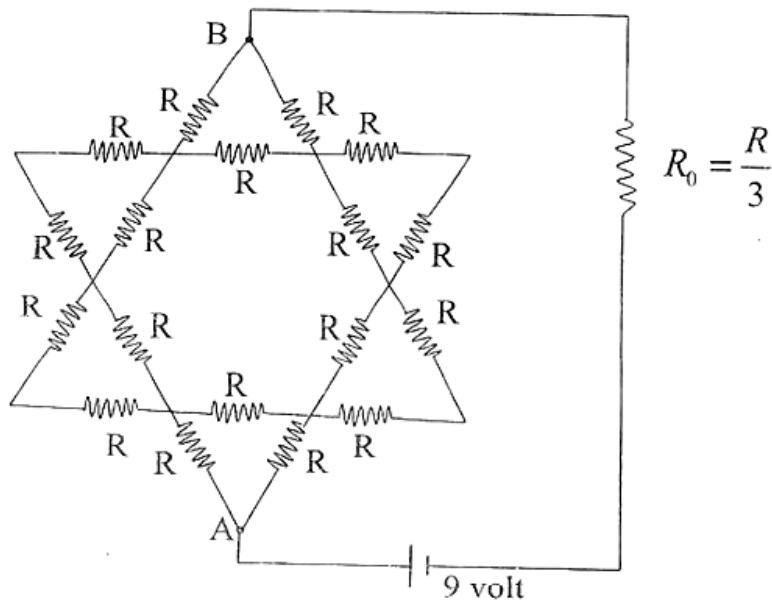
size of I_1 and I_2 will be same so magnification by lens

$$m_1 = \frac{+30}{-15} = -2$$

$$\text{magnification by plane mirror } m_2 = -\frac{v}{u} = -\left(\frac{-10}{+10}\right) = +1$$

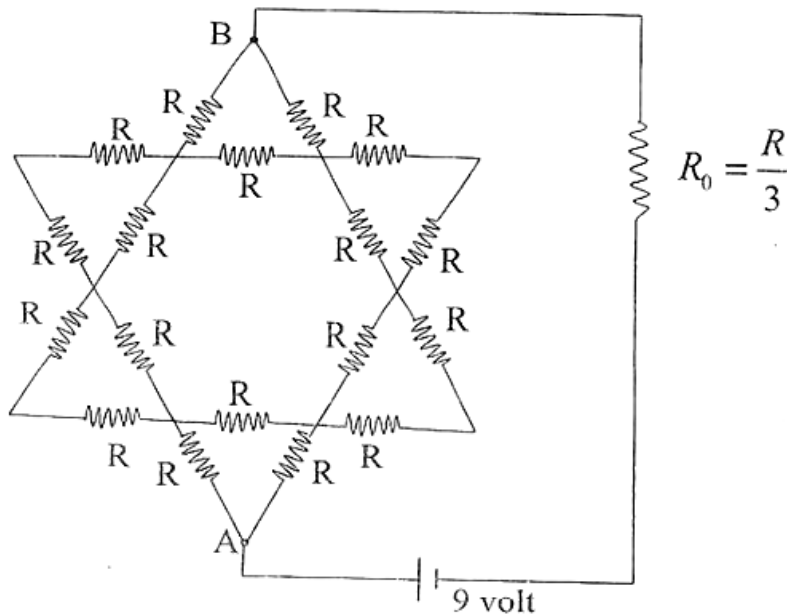
$$m = m_1 m_2 = -2 \times (1) = -2$$

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.

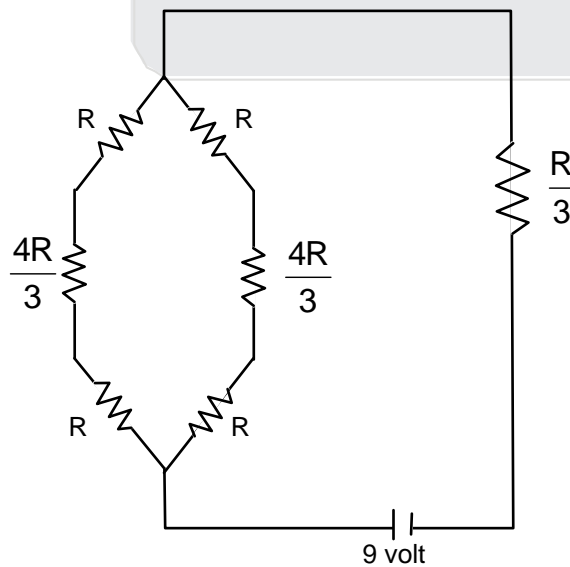
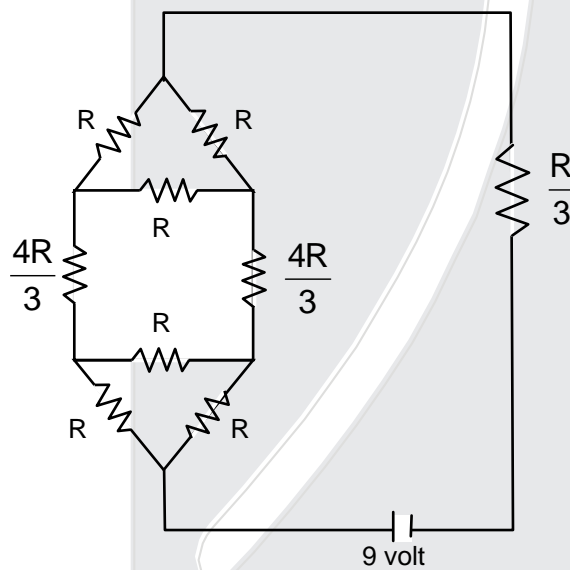
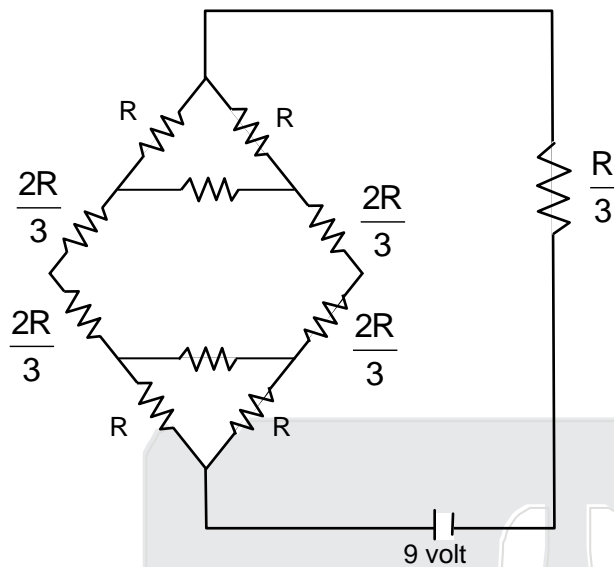


- (a) Current drawn from battery is 1.5 A
 (b) Potential difference between A and B is 7.5V
 (c) Electrical power dissipated in R_0 is 2.25 watt
 (d) Electrical power dissipated in network between A and B is 12.25 watt.

Ans. (a,b,c)
 Sol.



$$R_1 = \frac{5R}{3} \text{ or } R_{eq} = \frac{5R}{3} + \frac{R}{3} = 2R$$



$$R' = \frac{4R}{3} + 2R = \frac{4R + 6R}{3} = \frac{10R}{3}$$

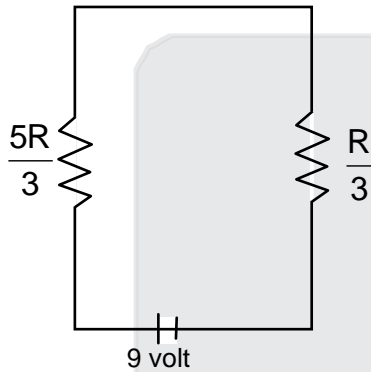
$$\frac{1}{R_{eq}} = \frac{3}{10R} + \frac{3}{10R}$$

$$\frac{1}{R_{eq}} = \frac{6}{10R} \Rightarrow R_{eq} = \frac{10R}{6}$$

$$R'_{eq} = \frac{10R}{6} + \frac{R}{3} = \frac{10R + 2R}{6} = 2R$$

$$I = \frac{9}{2R} = \frac{9}{2 \times 3} = \frac{9}{6} = \frac{3}{2} = 1.5 \text{ A.}$$

Potential difference between A and B



$$V_{AB} = 1.5 \times \frac{5R}{3}$$

$$= 1.5 \times 5 = 7.5 \text{ volt}$$

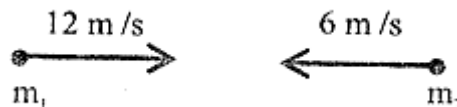
$$\text{Power in } R_0 \text{ is } = I_2 \times \frac{R}{3} = (1.5)^2 \times \frac{3}{3} = 2.25 \text{ watt.}$$

$$\text{Power between A \& B} = I^2 \times \frac{5R}{3}$$

$$= (1.5)^2 \times \frac{5 \times 3}{3}$$

$$= 2.25 \times 5 = 11.25 \text{ watt.}$$

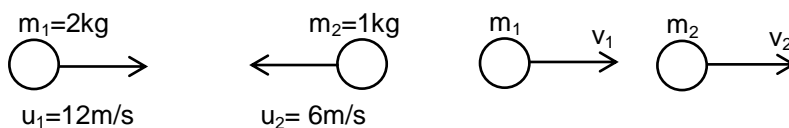
55. Two bodies of masses $m_1 = 2 \text{ kg}$ and $m_2 = 1 \text{ kg}$ are moving towards each other in the same straight line with speed 12 m/s and 6 m/s respectively as shown in figure. The bodies can be assumed as point masses. After some time, the two bodies undergo elastic collision. After the collision



- (a) the two bodies nearly exchange their velocities
 (b) m_1 come 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.

Ans. (b,c)

Sol.



\therefore By conservation of momentum

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$2 \times 12 - 1 \times 6 = 2v_1 + v_2$$

$$2v_1 + v_2 = 18 \quad \dots (1)$$

$$\therefore \frac{v_2 - v_1}{u_1 - u_2} = e \text{ for elastic collision } e = 1$$

So $v_2 - v_1 = u_1 - u_2$
 $v_2 - v_1 = 12 - (-6)$
 $v_2 - v_1 = 18 \quad \dots (2)$

from (1) & (2)

$$2v_1 + v_2 = 18$$

$$-v_1 + v_2 = 18$$

$$+ \quad - \quad -$$

$$3v_1 = 0 \text{ or } v_1 = 0$$

m_1 will stop

from (1) $2 \times 0 + v_2 = 18$

$$v_2 = 18 \text{ m/s to words right}$$

56. Which of the following evolutionary lineages of man can be categorized under pre-historic man?

- (a) Ramapithecus (b) Homo habilis
 (c) Homo sapiens fossils (d) Homo heidelbergensis

Ans. (b, d)

57. Select the set of diseases caused by deficiency of B-Complex Vitamins:

- (a) Beri-Beri & Pellagra (b) Dermatitis & Wernicke-Korsakoff Syndrome
 (c) Cheilosis & Pernicious anaemia (d) Marasmus & Kwashiorkor

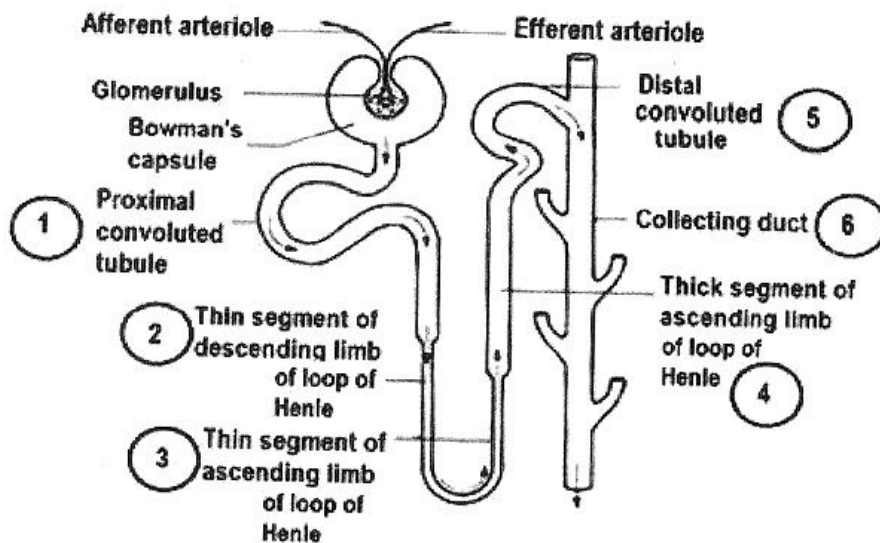
Ans. (a, b, c)

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, Ricciafluitans & (Cosmarium)
 (b) Ulothrix, Chiorella, Chara & Ricciocarpus natans
 (c) Marchantia, Funaria, Lycopodium & Gnetum
 (d) Salvinia molesta, Azolla, Chlorella & Cladophora

Ans. (a, b, d)

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 per tubular 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

Ans. (a, b, c)

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) $[\text{H}^+] > 10^{-7} \text{ M}$

Ans. (b, c, d)

Sol. $\text{NH}_4\text{Cl} \longrightarrow \underbrace{\text{NH}_4\text{OH}}_{\text{weak base}} + \underbrace{\text{HCl}}_{\text{Strong acid}}$

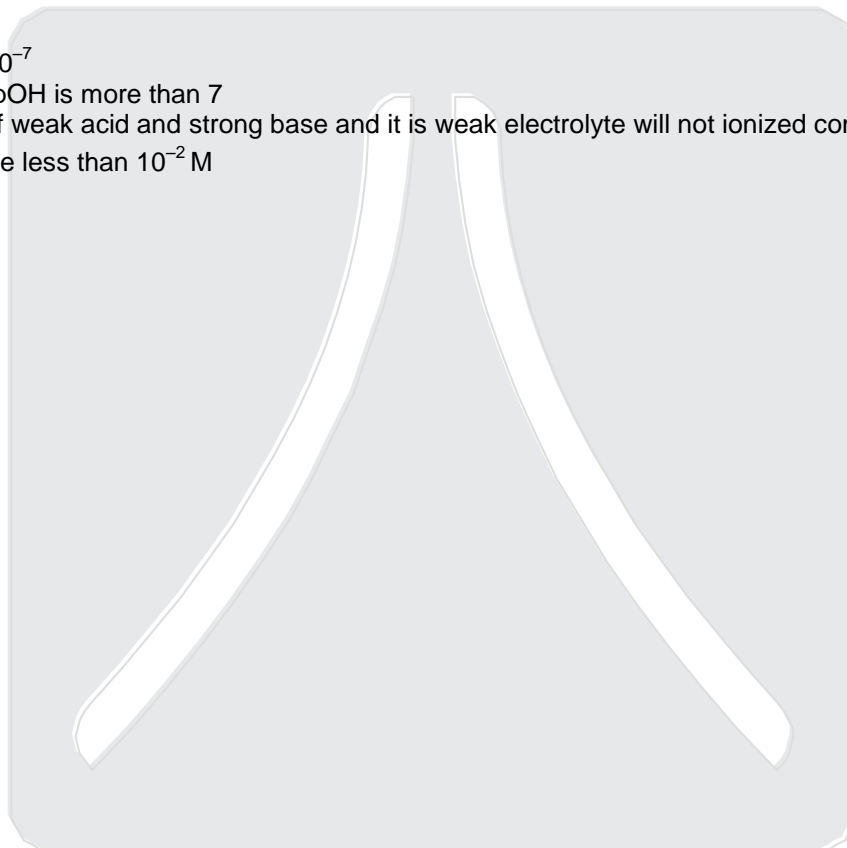
$\text{pH} < 7$

So, $[\text{H}^+] > 10^{-7}$

Therefore, pOH is more than 7

It is a salt of weak acid and strong base and it is weak electrolyte will not ionized completely.

$[\text{NH}^+_{4}]$ will be less than 10^{-2} M



RESONites ने फिर लहराया सफलता का परचम

STUDENTS FROM CLASSROOM PROGRAM (ONLINE / OFFLINE)

JEE (ADV.) 2022

AIR 6
KARTHIKEYA POLISETTY
Reso Roll No. 21925115
Course: I-VIJETA

AIR 8
DHEERAJ KURUKUNDA
Reso Roll No. 21925114
Course: I-VIJETA

AIR-1 GEN-EWS

NEET (UG) 2022

AIR 13
VRAJESH V. SHETTY
Reso Roll No. B20013403
Classroom Student (ResoBASE)

AIR 27
RISHIT AGARWAL
Reso Roll No. 21537750
Online Classroom Student

710 / 720

705 / 720

8 ALL INDIA RANKS IN TOP-60

ZONAL RANK-2 IT BHUBANESHWAR	ZONAL RANK-1 IT GUWAHATI	ZONAL RANK-1 IT KANPUR
AIR 11 DEEVYANSHU MALU RRN: 21219044	AIR 15 ABHIJEET ANAND RRN: 21925116	AIR 35 SANSKAR SHAURYA RRN: 21925113
AIR 50 ANIRUDH GARG RRN: 21220122	AIR 54 SOUMITRA D. NAYAK RRN: 21220554	AIR 58 KANISHK SHARMA RRN: 21220454

10 ALL INDIA RANKS IN TOP-1000

CITY TOPPER JAMNAGAR	AIR 209 THANAK M. PARMAR RRN: 20173217	AIR 323 NITHIN S RRN: B19022058	AIR 414 LYSIRI N. BABU RRN: B17281512	AIR 547 VRISHAN V. SHETTY RRN: B20013404	AIR 645 NITHIN D RRN: B20011564	AIR 680 PRIYANSHU SINHA RRN: 20530533	AIR 779 PRANAV D RRN: B19022045	AIR 895 SAMIT SEN RRN: B20007850
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43.74% Selection Ratio in
JEE (Advanced) 2022

86.92% Selection Ratio in
NEET (UG) 2022

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for Academic Session 2023-24

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