

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

HINTS & SOLUTIONS

1. b
Sol. Slope of s-t graph gives velocity which is constant in graph (ii).

2. d

Sol. $R = \frac{V^2}{P} = \frac{(220)^2}{60}$

Bulbs B and C are in parallel and then in series to bulb A

$$R_{\text{net}} = \frac{R}{2} + R = \frac{3R}{2}$$

$$\begin{aligned} \text{Total power} &= \frac{V^2}{R_{\text{net}}} = \frac{(220)^2}{\frac{3}{2}R} \\ &= \frac{(220)^2}{\frac{3}{2} \times \frac{(220)^2}{60}} = \frac{60 \times 2}{3} = 40 \text{ W} \end{aligned}$$

3. c

Sol. $R = \frac{\rho \ell}{A}$

where $A = \pi r^2$

when wire is stretched to 'n' times its length, then

$$R_{\text{new}} = n^2 R$$

$$\frac{\Delta R}{R} = 4 \frac{\Delta r}{r} = 0.6 \%$$

4. b

Sol. $T_1 = 273 \text{ K}, T_2 = 273 + 27 = 300 \text{ K}$

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

$$\frac{V_2}{V_1} = \sqrt{\frac{T_2}{T_1}}$$

$$V_2 = \sqrt{\frac{T_2}{T_1}} V_1 = \sqrt{\frac{300}{273}} \times 332 = 348 \text{ m/s}$$

Given velocity at 27°C is 352 m/s

$$\frac{\Delta V}{V} \times 100\% = 1.15\%$$

5. a

- Sol. In some plants and fungi, glyoxysomes convert lipids to sugar in early stages of oil seed's germination.
6. b
Sol. In the analysis of waste water, Escherichia coli is used as an indicator of fecal contamination of water.
7. b
Sol. The most suitable pH range for the survival of aquatic biota is 6.5 – 7.5.
8. c
Sol. On the basis of intensity, Estradiol is produced in large amount from ovaries.
9. c
Sol. Sacral vertebrae is related with the pelvis region.
10. c
Sol. At enzyme level E7 and E10 ATPs are generated at substrate level.
11. d
Sol. Corpus callosum is found bulging upon the inner surface of the dorsal wall of each cerebral hemisphere of mammalian brain.
12. a
Sol. Giardia exhibit bilateral symmetry.
13. c
Sol. Nissl's granules are found in neurons.
14. c
Sol. The virion replicates autonomously outside the host is not applicable to viruses.
15. a
Sol. Carolus Linnaeus, classification system is artificial.
16. d
Sol. Hydrogen attached with D-bond is acidic so it will ionize in aq solution.
17. a
Sol. $N_1 > N_2 > N_3 > N_4$
i.e: H > C > Cl > Co
Hydrogen forms the highest number of compounds when it combines with different elements then the sequence as given
18. b
Sol. Heaviest nuclide which does not show radioactive nature is lead.
19. c
Sol. No. of moles of urea = 0.2 \Rightarrow Mass of urea = 12 g
No. of moles of water = 0.8
Mass of water = 14.4 g
Total mass of solution = 14.4 + 12 = 26.4 g
1000 g of solution will contain = $\frac{12}{26.4} \times 1000 = 454 \text{ g} = 7.57 \text{ moles of urea}$
Mass of water in diluted solution = 5000 – 454 = 4546 g

$$n_{\text{water}} = \frac{4546}{18} = 252.55 \text{ moles}$$

$$x_{\text{urea}} \text{ in diluted solution} = \frac{7.57}{7.57 + 252.55} = 0.029$$

20. a

Sol. $\frac{R_{\text{CH}_4}}{R_{\text{Ni}(\text{CO})_x}} = 3.24$

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

$$\sqrt{\frac{58.7 + 12x + 16x}{16}} = 3.24$$

$$x = 3.9022$$

21. c

Sol. % ionic character in LiH = $\frac{1.964 \times 10^{-29}}{1.596 \times 10^{-10} \times 1.6 \times 10^{-19}} \times 100 = 76.8\%$

22. b

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

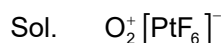
$$\Rightarrow x = 1.785 \text{ g} \Rightarrow \text{Amount of MgCO}_3 = 0.215$$

$$\% \text{MgCO}_3 = \frac{0.215}{2} \times 100 = 10.75 \approx 11$$

23. d

Sol. $\text{C}_6\text{H}_5\text{CH}_3$
 $7x + 8 = 0$
 $7x = -8$

24. c



$$2x = +1$$

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

25. c

Sol. Position of H_C is in conjugation with respect to double bond.

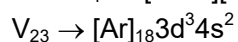
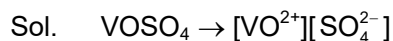
26. a

Sol. Molecular formula is $\text{C}_{10}\text{H}_{16}$ implies its D.B.E is 3. Hence total no. of π -bonds possible are 3 or may be 2π bond with 1 ring or may be 1π bond with 2 rings or may be 3 rings are possible.

27. c

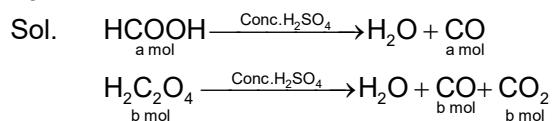
Sol. Adsorbing capacity of Pd is highest.

28. c



$V^{4+} \rightarrow [Ar]_{18} 3d^1 4s^0$ implies paramagnetic blue colour due to d-d transition.

29. b



Total moles of CO formed = a + b

Moles of CO₂ formed = b

Total moles of gases = a + b + b = a + 2b

Moles of CO₂ = $\frac{1}{6}(a + 2b)$

$b = \frac{1}{6}(a + 2b)$

$\frac{a}{b} = \frac{4}{1}$

30. a

Sol. $3s = 3p = 3d > 2s$

No energy difference among sub-shells in hydrogen atom.

31. d

Sol. No solute will be passed through semipermeable membrane hence no chemical reaction takes place.

32. c

Sol. Retardation of ball inside water

$$a = \left(\frac{\sigma_{\text{toy}} - \sigma_{H_2O}}{\sigma_{\text{toy}}} \right) g$$

$a = -9.8 \text{ m/s}^2$

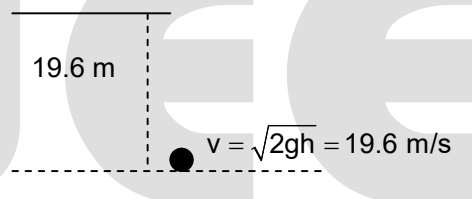
Time taken by toy inside water

$T = \frac{2v}{a} = \frac{2 \times 19.6}{9.8} = 4s$

Time taken by toy to fall = $\sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 19.6}{9.8}} = 2s$

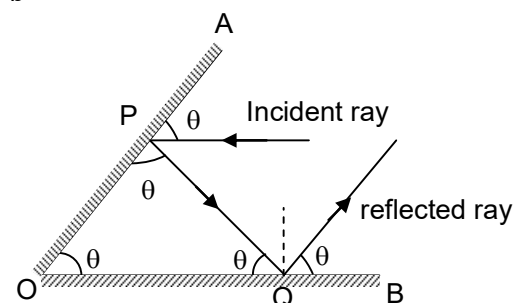
Time taken to reach up again.

Total time = 2 + 4 + 2 = 8 s



33. b

Sol.



From ΔPOQ , $3\theta = 180^\circ$

$\Rightarrow \theta = 60^\circ$

34. c

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

35. c

Sol. $F = (\sigma_{\text{liq}} \cdot g \cdot h \cdot A) - (\sigma_{\text{water}} \cdot g \cdot h \cdot A)$
 $= 0.8 \times 10^3 \times 9.8 \times 5 \times 10^{-4}$
 $= 39.2 \text{ N}$

36. c

Sol. Using Fleming's Left Hand Rule

37. d

Sol. Raman Effect is the discovery of inelastic scattering of light.

38. d

Sol. This led to the discovery of a phytohormone, Gibberellin.

39. b

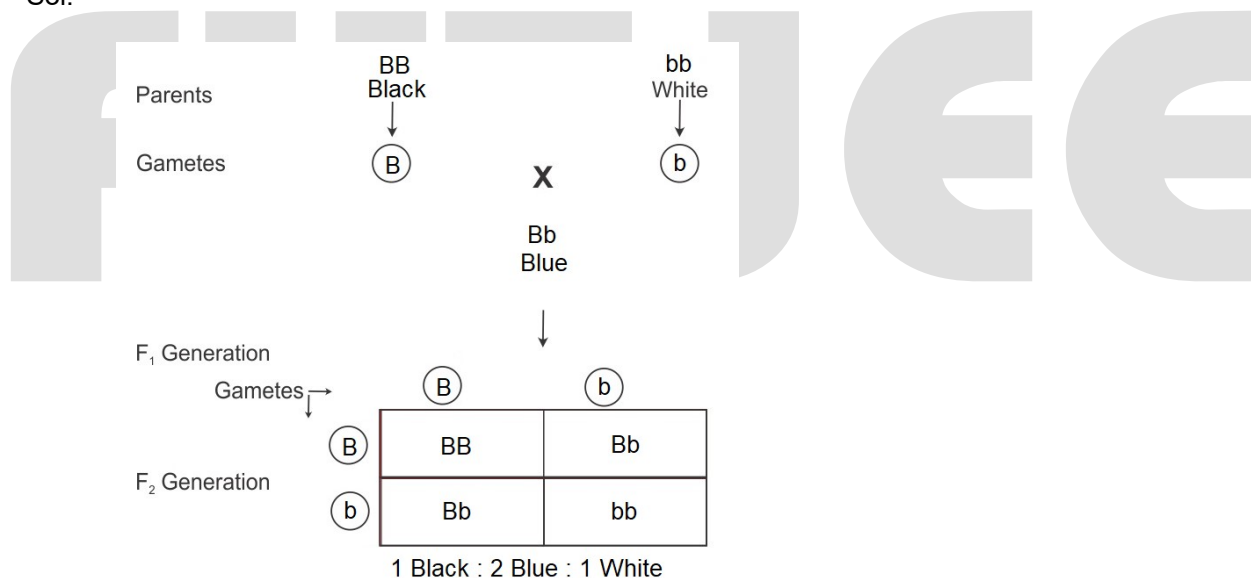
Sol. In the given diagram the three possibilities of pollen tube entry are:
A – Progamy, B – Chalazogamy & C - Mesogamy

40. c

Sol. In the members of Cucurbitaceae family Bicollateral vascular bundles is a special feature which also helps in translocation of food.

41. a

Sol.



42. a

Sol. The sequence of pigment bands from below upwards is Chlorophyll b, Chlorophyll a, Carotenols & Carotenes.

43. b

Sol. $P = \frac{w}{t} = \frac{\Delta k}{t}$
 $\Rightarrow 1.5 = \frac{\Delta k}{t} = \frac{15}{t} \Rightarrow t = 10 \text{ sec}$

44. c

Sol. From conservation of momentum

$$m_1 v_1 = m_2 v_2$$

Since sand leaking out of bag remains in trolley, hence mass $m_1 = m_2$
 $\Rightarrow v_1 = v_2 = 10 \text{ m/s}$

45. a

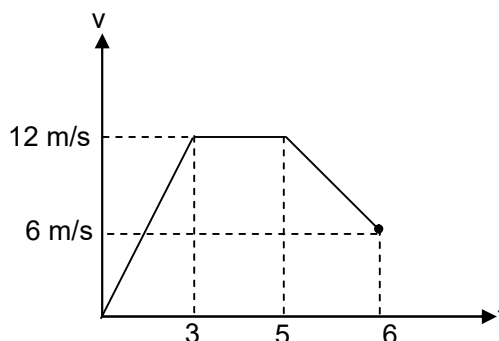
Sol. $v = u + at$

$$v = 0 + 4 \times 3$$

$$= 12 \text{ m/s}$$

Area under v-t graph gives displacement

$$S = 51 \text{ m}$$



46. a

Sol. From conservation of energy

$$-\frac{GMM}{d} = \frac{-GMM}{\frac{d}{2}} + 2 \times \frac{1}{2} Mv^2$$

$$\Rightarrow Mv^2 = \frac{2GM^2}{d} - \frac{GM^2}{d}$$

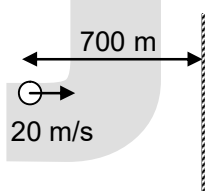
$$\Rightarrow v^2 = \frac{GM}{d} \Rightarrow v = \sqrt{\frac{GM}{d}}$$

47. b

Sol. $330t = 700 + (700 - 20t)$

$$\Rightarrow 330t + 20t = 1400$$

$$\therefore t = \frac{1400}{350} = 4 \text{ sec}$$



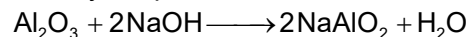
48. c

Sol. $\rho v g = 0.8 \frac{v}{2} g + 13.6 \times \frac{v}{2} g$

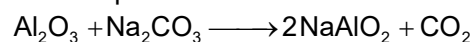
$$\rho = 0.4 + 6.8 = 7.2 \text{ g/cc}$$

49. a, b

Sol. In Baeyer's process



In Hall's process



50. b, d

Sol. From period 6 to period 7, ionization energy increases due to poorest shielding effect of f-orbital.

51. ad

Sol. After valve is opened, pressure of both containers becomes identical. Now since container Y has more temperature so its rate of evaporation will increase as compared to container X where rate of condensation will increase. So, therefore mass of water decrease in container Y and increases in container X.

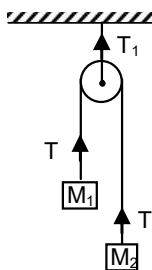
52. b, d

Sol. $T = \frac{2M_1M_2}{M_1 + M_2}g = 4 \text{ kg wt}$

$T_1 = 2T = 8 \text{ kg wt}$

$a = \left(\frac{M_2 - M_1}{M_1 + M_2}\right)g = \frac{9.8}{3} \text{ m/s}^2$

Option (b) and (d)



53. a, c

Sol. For lens, using $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

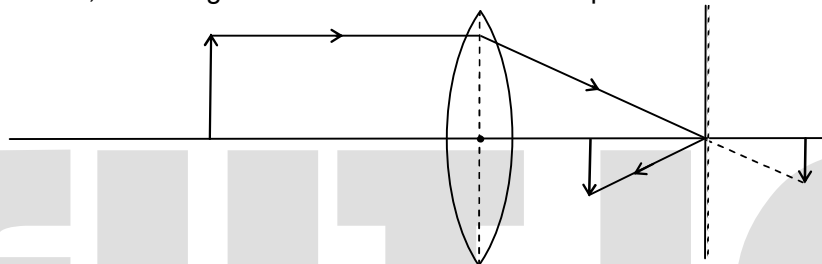
$u = -15 \text{ cm}$

$f = 10 \text{ cm}$, we get $v = 30 \text{ cm}$

$m = \frac{v}{u} = \frac{30}{-15} = -2$

For plane mirror, $u = 10 \text{ cm}$ and $v = 10 \text{ cm}$

Hence, final image is formed at 10 cm between plane mirror and lens



Option (a) and (c)

54. a, b, c

Sol. After simplification of circuit

Given $R = 3 \Omega$

$R_{AB} = \frac{5R}{3} = 5\Omega$

$R_{net} = \frac{5R}{3} + \frac{R}{3} = 2R$

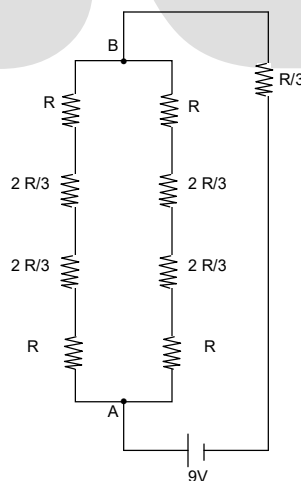
$R = 3\Omega$

$R_{net} = 2R = 6 \Omega$

$i = \frac{V}{R} = \frac{9}{6} = 1.5 \text{ A}$

$V_{AB} = iR_{AB} = 1.5 \times 5 = 7.5 \text{ V}$

Power across $R_0 = i^2 R_0 = (1.5)^2 \times 1 = 2.25 \text{ W}$



55. b, c

Sol. From conservation of momentum

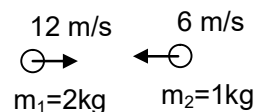
$m_1\vec{v}_1 + m_2\vec{v}_2 = 12 \times 2 - 6 \times 1 = 6 \text{ kg m/s} \quad \dots(1)$

From conservation of energy

$\frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 = \frac{1}{2}m_1 \times 12^2 + \frac{1}{2}m_2 \times 6^2 \quad \dots(2)$

Solving equation (1) and (2)

$v_1 = 0$ and $v_2 = 18 \text{ m/s}$



56. b,d
Sol. Homo habilis, Homo heidelbergensis can be categorized under pre-historic man.
57. a,b,c
Sol. Beri-Beri & Pelagra, Dermatitis & Wernicke-Korsakoff Syndrome and Cheilosis & Pernicious anaemia caused by deficiency of B-Complex Vitamins.
58. abd
Sol. Plants of options a, b and d are likely to found in a pond water.
59. b, c
Sol. Part 1 have columnar epithelial cells with 'brush border', suitable for reabsorption and part 2 & 3 mark as completely poorly permeable to water.
60. bcd
Sol. NH_4Cl solution is acidic since NH_4^+ will hydrolyse in water to form NH_4OH .

FIITJEE