

### CET MOCK TEST – 4 (SOLUTIONS)

1. c

The light year is the distance traveled by light in free space in one year

2. b

$S = ut + \frac{1}{2} at^2$ .  $u = 0$ , Therefore  $S = \frac{1}{2} at^2$ . For uniform acceleration 'a' is constant.

Therefore,  $S \propto t^2$

3. a

Since,  $F = ma$ , we have  $a = F/m$

For mass A,  $a = F / m = 10/10 = 1 \text{ m/s}^2$

For mass B,  $a = F / m = 10/20 = \frac{1}{2} \text{ m/s}^2$

For mass C,  $a = F / m = 10/30 = \frac{1}{3} \text{ m/s}^2$

For mass D,  $a = F / m = 10/40 = \frac{1}{4} \text{ m/s}^2$

4. c

$$a = \omega^2 r \quad a = (2\pi f)^2 r = (2\pi \times 1200/6)^2 \times 0.04 = 6318 \text{ m/s}^2$$

5. c

$$F = 4 \text{ N}, \theta = 60^\circ \quad v = 3 \text{ m/s}$$

$$\text{Instantaneous power } P = Fv \cos \theta = 4 \times 3 \times \cos 60^\circ = 12 \times \frac{1}{2} = 6 \text{ W}$$

6. d

$P = \sqrt{2mE}$  when KE  $E$  is measured 4 times then momentum  $P$  doubles.

$$P \propto \sqrt{E}$$

7. a

Work done against gravity = change in KE

$$= \frac{1}{2} m (v^2 - u^2) = \frac{1}{2} \times 0.1 (0 - 5^2) = \frac{1}{2} \times 0.1 (0 - 25) = - 1.25 \text{ J}$$

8. a

$$\text{Wkt, } m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$0 + 0 = 4 \times V_1 + 12 \times 4. \text{ Therefore } V_1 = -12 \text{ m/s}$$

$$\text{KE of 1st mass is } = \frac{1}{2} m_1 v_1^2$$

$$= \frac{1}{2} \times 4 \times 144 = 288 \text{ J}$$

9. a

Wkt  $S_1 = t \sec. \sin(i-r)$ . Therefore  $S_1 \propto t$

10. c

R.I  $\propto$  lateral shift. Glass to water. R.I decreases.

Therefore lateral shift produced is less than X.

11. a

Because the correct expression is  $A/A^1 = - (n^1 - 1) / (n - 1)$

12. b Wkt  $f_w = 4 f_a = 4 \times 0.8 = 3.2 \text{ m}$

13. c

14. a

The fringe contrast is given by  $I_{\min} / I_{\max} = (a_1 - a_2)^2 / (a_1 + a_2)^2$

Fringe contrast is best when  $I_{\min} = 0$  or  $a_1 = a_2$  this implies  $I_1 = I_2$

15. d

16. c

Linear width of central maximum  $\beta = 2D \lambda / d$  this implies  $\beta \propto \lambda$ . Since  $\lambda_B < \lambda_R$ , width of central maximum decreases and other secondary maximum become narrower and closer.

17. c

Along the optic axis both o-ray and E-ray travel with same velocity. RI of crystal,  $n = c/v$

When  $v$  is same for both the rays,  $n$  (RI) of the crystal is also same for both the rays.

18. b

When light is incident at polarizing angle, the reflected and refracted rays remain perpendicular to each other. Therefore  $\theta_p + r = 90^\circ$  the deviation  $d = \theta_p - r$  this implies  $\theta_p = 57^\circ$

19. d

Hint:  $qV = W$

$$= E$$

$$= \frac{1}{2} mv^2$$

$$v^2 = (2qV) / m$$

$$= 16 \times 10^{12}$$

$$v = 4 \times 10^6 \text{ m/s}$$

20. a

Since  $E = 0$  ,  $E = dv/dx$  ,  $0 = dv/dx$  , Therefore  $v = \text{constant}$

21. a

$$C' / C = n^{1/3} = 125^{1/3} = 5 . \text{ Therefore } C' = 5C$$

22. b

$$V = Q / C \quad V_1 = Q_1 / C_1 \dots\dots\dots(1)$$

$$Q_1 = Q_2 = Q \text{ since series. } Q = Cs V \text{ -----}(2)$$

$$Cs = C_1 C_2 / C_1 + C_2 \text{ -----}(3)$$

23. b

$$\text{Wkt, } R^2 = P^2 + Q^2 + 2PQ \cos \theta, \text{ But } P=Q=R, \text{ therefore } R^2 = P^2 + Q^2 + 2PQ \cos \theta$$

This implies  $\cos \theta = -\frac{1}{2}$  therefore  $\theta = 120^\circ$

24. a

25. c

26. c

27. d

$$\text{Efficiency, } n = 1 - T_2/T_1 = 1 - Q_2/Q_1$$

$$(T_1 - T_2) / T_1 = (Q_1 - Q_2) / Q_1 = W / Q_1$$

This implies that ,  $Q_1 = [T_1 / (T_1 - T_2) ] W = (800 \times 1000) / 400 = 2000J$

28. b

29. b

$$\text{Wkt, } y = a \sin(\omega t - kx)$$

$$\omega = 314 \text{ rad/s} \quad \text{ie} \quad 2\pi f = 314 \quad f = 50 \text{ Hz}$$

30. b

31. a

$$f_1 : f_2 : f_3 : \dots = 1 : 2 : 3 : 4 : \dots$$

32. a

$$\text{Fundamental frequency } f = v / 4l = 340 / (4 \times 0.5) = 170 \text{ Hz}$$

$$\text{The first overtone } f_1 = 3f = 510 \text{ Hz}$$

33. b

$$\text{Hint: } J = I / A = 50 \times 10^{-6} / 50 \times 10^{-6} = 1 \text{ A/m}^2$$

34. c

$$\text{Hint: Potential diff, } V = W / Q = 15 / 5 = 3 \text{ V}$$

35. d

Hint: For balanced  $P/Q = R/S$ , when interchanged  $P/S$  is not equal to  $R/Q$ . Therefore network is not balanced.

36. c

$$\text{Hint: For balancing wheat stones network, } P/Q = R/S \quad \text{i.e. } 16/12 = 9/3+x$$

$$24 = 12 + 4x \quad \text{this implies} \quad 12 = 4x, \quad x = 3 \Omega$$

37. b

$$\text{Hint: Field inside the solenoid, } B = \mu_0 n I = \mu_0 \times 1000 \times 2 = 2000 \mu_0$$

38. b

$$\text{Hint: } \tan \theta = B_V / B_H = 1/\sqrt{3} \quad \text{Therefore, } \theta = 30^\circ$$

39. d

40. c

$$\text{Hint: Wkt, } R = (V/I_g) - G = (10 / 10 \times 10^3) - 1 = 1000 - 1 = 999 \Omega$$

41. c

$$\text{Hint: Out power} = 140 \text{ Watt}$$

$$\text{Input power} = 240 \times 0.7 = 168 \text{ Watt}$$

$$\text{Efficiency} = (\text{out put power} / \text{input power}) \times 100$$

$$= (140 / 168) \times 100 = 83.3 \%$$

42. b

$$\text{Hint: } \frac{1}{2} CV^2 = \frac{1}{2} LI^2 \quad \text{therefore, } C = L I^2 / V^2 = 1 \times 2^2 / 400^2 = 25 \mu\text{F}$$

43. c

$$\text{Hint: } E = -d\phi / dt = (1000 - 100) / 60 = 15 \text{ V}$$

44. d

45. a

$$\text{Hint: Stop pot ( } V_s \text{) in Volt} = KE \text{ (eV)}$$

$$= \frac{1}{2} m V^2 \text{ J}$$

$$= \frac{1}{2} (m V^2) / e \quad \text{eV} = \frac{1}{2} V^2 / (e/m) = \frac{1}{2} \times [(1.8 \times 10^6)^2] / 1.8 \times$$

$$10^{11} = 9 \text{ eV}$$

$$V_s = 9\text{V}$$

46. d

$$\text{Hint: } \frac{1}{2} m V^2 = e V_0, \quad \frac{1}{2} V^2 = (e/m) V_0$$

$$\frac{1}{2} (3.5 \times 10^6)^2 = 1.75 \times 10^{11} V_0 \quad \text{This implies, } V_0 = 35 \text{ Volts}$$

47. b

$$\text{Hint: } r_n = r_1 n_2$$

$$r_{10} = 0.05 \times 10^2 = 0.05 \times 100 = 5 \text{ nm}$$

48. b

Hint:  $E_n = - E_1 / n^2 = - 13.6 / 4^2 = - 0.85 \text{ eV}$

49. c

50. d

51. b

Hint:  $A = 238$  ,  $Z = 92$  ,  $N = A - Z = 238 - 92 = 146$

52. a

Hint:  $R = R_0 A^{1/3} = 1.1 \times 10^{-15} (64)^{1/3} = 4.4 \text{ fermi}$

53. c

54. b

55. b

Hint:  $T_{av} = 1/\lambda$  and half life ,  $T = 0.693 / \lambda$  ,  $T_{av} / T = 1/ 0.693 = 1.44$

56. c

Hint: The complete life time of a radioactive sample is infinity

57. a

58. b

59. c

60. d