clamphook

Shift 3 | July 8

Clamphook CBT

2080

Full Marks: 140 **Time:** 2 hours **Pass Marks:** 56

1. The mean time period of second's pendulum is 2.00 s and mean absolute error in the time period is 0.05 s. To express maximum estimate of error, the time period should be written as

a. $(2.00 \pm 0.01)s$
b. $(2.00 + 0.025)s$
c. $(2.00 \pm 0.05)s$
d. $(2.00 \pm 0.10)s$

2. If a man of weight 64 kg carries 6N bag then upward force on his feet is [IOE 2078]

a. 646 N
b. 640 N
c. 6N
d. 634N

3. If the radius of the earth is reduced to half of its present value, with no change in the mass, the acceleration due to gravity will be: [IOE 2077]

a. four times
b. two times
c. remains same
d. halved

4. The moment of inertia of a thin rod of mass M, Length l , about an axis passing through a point L/4 from one end and perpendicular to length is

a. $\frac{7}{48}ML^2$
b. $\frac{1}{3}ML^2$
c. $\frac{1}{12}ML^2$
d. $\frac{31}{48}ML^2$

5. If the excess pressure in a soap bubble is three times the other one. The ratio of their volume is

a. $1:3$
b. $1:9$
c. $1:27$
d. $1:81$

6. The specific heat capacity of a gas in an adiabatic process is [IOE 2077]

a. infinity
b. unity
c. negative
d. zero

7. If a gas is allowed to expand adiabatically against external pressure

a. Its temperature remains constant
b. Pressure remains constant
c. There is increase in internal energy
d. There is decrease in internal energy

8. The focal length of a convex lens is f. An object is placed at a distance x from its first focal point . The ratio of the size of the real image to that of the object is

a. $\frac{f}{x^2}$

b. $\frac{x^2}{f}$

c. $\{\frac{f}{x}$

d. $\frac{x}{f}$

---

9. A monochromatic beam of light passes from a denser medium to a rarer medium . As a result

a. Its speed decreases

b. Its frequency increases

c. Its speed increases

d. Its frequency decreases

---

10. 8 small drop of capacitance and radius V combines to form a big drop of radius R then the capacitance of big drop will be

a. 2 C

b. 4 C

c. 8 C

d. 16 C

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11. The emf is a thermo couple changes sign at 600 K. if the neutral temperature is $210^{\circ}C$, the temperature of cold junction is

a. 180 K

b. 117 K

c. $93^{\circ}C$

d. $90^{\circ}C$

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12. A magnet of magnetic moment M is revolved end for end in a uniform magnetic field B . The change in kinetic energy of the magnet will be

a. $4MB$

b. MB

c. $3MB$

d. $2MB$

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13. When an electric motor is run at 120 volt, 10A current flows through it and the induced back emf is 115 volts. What will be the current flowing in the coil at the time of switch off?

a. 230 A

b. 10 A

c. 240 A

d. zero

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14. In Young's double slit experiment , 12 fringes are obtained in a certain fragment of the screen when light of wavelength 600 nm is used . If the wavelength of the light is changed to 400 nm , number of fringes obtained in the same segment of the screen will be :

a. 12

b. 24

c. 18

d. 30

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15. A source of frequency n gives 5 beats/ sec when sounded with a source of frequency 200 Hz. The second harmonic 2n gives 10 beats per second when sounded with a source of frequency 420 Hz. Then n is equal to

a. 205 Hz

b. 210 Hz

c. 200 Hz

d. 195 Hz

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16. An electron after being accelerated through a p.d of $100V$ enters a uniform magnetic field 0f $0.004T$ perpendicular to its direction of motion . Then the radius of the path described by the electron will be

a. $84mm$

b. $82mm$

c. $8.4mm$

d. $8.2mm$

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17. Calculate I_e in a transistor for which β = 50 and $I_b = 25\mu A$

a. $2mA$

b. $1.525mA$

c. $1.275mA$ d. $1mA$

18. If $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$ then which of the following relations from $A \to R\{\text{the set of real numbers}\}$ is not a function?

a. $R_1 = [\{x, f(x) : x \in A, f(x) = 6x + 3\}$

b. $R_1 = [\{x, f(x) : x \in A, f(x) = 6|x| + 2\}$

c. $R_1 = [\{x, f(x) : x \in A, f(x) = \dfrac{1}{x^2 + y^2}$

d. $R_1 = [\{x, f(x) : x \in A, f(x) = \pm 2x\}$

19. If in the determinant $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ etc. be the co-factors of a_1, b_1, c_1 etc., then which of the following relations is incorrect

a. $a_1A_2 + b_1B_2 + c_1C_2 = 0$

b. $a_2A_2 + b_2B_2 + c_2C_2 = 0$

c. $a_1A_1 + b_1B_1 + c_1C_1 = 0$

d. $a_3A_3 + b_3B_3 + c_3C_3 = 0$

20. z, z_1 and z_2 are any three complex numbers. Then which of the following is not true?

a. $\arg(z_1z_2) = \arg(z_1) + \arg(z_2)$

b. $\arg\left(\dfrac{z_1}{z_2}\right) = \arg(z_1) - \arg(z_2)$

c. $\arg(z) = 2\pi - \arg(\bar{z})$

d. $\arg(z) + \arg(\bar{z}) = \dfrac{\pi}{2}$

21. $\dfrac{2}{1!} + \dfrac{2+4}{2!} + \dfrac{2+4+6}{3!} + \dfrac{2+4+6+8}{4!} + \ldots + \infty =$

a. $e+1$ b. $3e$

c. $2e$ d. $e-1$

22. If $4\sin^{-1}(x) + \cos^{-1}(x) = \pi$, then x is equal to:

a. $-\dfrac{1}{2}$ b. $\dfrac{\sqrt{3}}{2}$

c. $\dfrac{1}{2}$ d. $\dfrac{3}{2}$

23. Value of $\cos\left[\tan^{-1}\left(\dfrac{3}{4}\right)\right]$ is:

a. $\dfrac{4}{5}$ b. $\dfrac{3}{4}$

c. $\dfrac{4}{3}$ d. $\dfrac{5}{4}$

24. In any triangle ΔABC, the value of $a\cot A + b\cot B + c\cot C$ is :

a. $R + r$ b. $2R + r$

c. $R + 2r$ d. $2(R + r)$

25. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ then $|\hat{a} - \hat{b}| =$ **[IOE 2074]**

a. $2\cos\dfrac{\theta}{2}$ b. $\cos\dfrac{\theta}{2}$

c. $2\sin\dfrac{\theta}{2}$ d. $\sin\dfrac{\theta}{2}$

26. The distance between the parallel lines $x^2 + 2xy + y^2 - 6x - 6y + 8 = 0$ is :

a. 1 b. $\sqrt{2}$

c. $\frac{1}{2}$ d. 2

27. The equation of the circle center at $(3, -4)$ and touching x − axis is :

a. $(x-3)^2 + (y-4)^2 = 4^2$ b. $(x-3)^2 + (y+4)^2 = 4^2$

c. $(x-3)^2 + (y-4)^2 = 3^2$ d. $(x-3)^2 + (y+4)^2 = 3^2$

28. . The vertex of the parabola $(y-a)^2 = 4a(x-a)$is :

a. (a,0) b. (0,0)

c. (0,a) d. (a,a)

29. The ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1(b > a)$ has its length of latus rectum as [IOE 2074]

a. $\frac{2b^2}{a}$ b. $\frac{2b}{a}$

c. $\frac{2a^2}{b}$ d. $\frac{2a}{b}$

30. Projection of a line joining (1, 2, 3) and (4, 5,6) on another line if it makes 30° with the line is [IOE 2076]

a. 3 units b. units

c. 9 units d. 9/2 units

31. $\lim_{x\to 0} x \sin(\frac{1}{x})$ [IOE 2078]

a. 0 b. 1

c. 2 d. Doesnt exist

32. Derivative of $\sec^{-1} x$ with respect to x? [IOE 2078]

a. $\frac{1}{x\sqrt{x^2-1}}$ b. $\frac{1}{\sqrt{x^2-1}}$

c. $-\frac{1}{x\sqrt{x^2-1}}$ d. $-\frac{1}{\sqrt{x^2-1}}$

33. If $f(x) = x + 2$ then $f'f(x)$ at x = 4 is:

a. 4 b. 1

c. 0 d. π

34. The function $f(x) = mx + c$, where m, c are constants , is a strictly decreasing functions for all x $\in$ R if

a. $m \geq 0$ b. $m > 0$

c. $m = 0$ d. $m < 0$

35. The adjacent sides of a rectangle with given perimeter as 100 cm and enclosing maximum area are

a. 25 cm and 25 cm b. 20 cm and 30 cm

c. 15 cm and 35 cm d. 10 cm and 40 cm

36. If $f'(x) = 3x^2 - \frac{2}{x}$ and $f(1) = 0$ then $\int f(x)dx =$ [IOE 2077]

a. $\frac{x^4}{4} - \ln x - 3x$ b. $\frac{x^4}{4} - 4\ln x - 3x$

c. $\frac{x^4}{4} + \frac{4}{x^3} - 3x$ d. $\frac{x^4}{4} - \frac{4}{x^3} - 3x$

37. Area enclosed by $y = x^2$ and $y = 1$ is [IOE 2078]

a. $\frac{2}{3}$ b. $\frac{1}{3}$

c. $\frac{4}{3}$ d. None

38. What is the result when benzene is nitrated at normal temperature? [IOE 2078]

a. Nitrobenzene b. Sym-trinitrobenzene

c. Nitrogen dioxide d. M-dinitrobenzene

39. The hybridization of carbocation is

a. sp^2 b. sp

c. sp^3 d. dsp^2

40. Yellow colour of usual nitric acid is due to the presence of

a. NO_2 b. N_2O

c. NO d. N_2O_5

41. Which is most reactive? [IOE 2077]

a. F b. Cl

c. Br d. I

42. When a standard solution of $NaOH$ is left in air for a few hours

a. A precipitate will form b. Strength will decrease

c. Strength will increase d. The concentration will increase of Na+ ions will remain constant

43. The tough cake copper is the copper obtained after purification of blister copper by

a. Electrorefining b. Poling

c. Liquation d. distillation

44. Which one of the following elements constitutes a major impurity in pig iron?

a. Carbon b. Oxygen

c. Sulphur d. Silicon

45. Amphoteric behavior is shown by

a. H_2CO_3 and Al_2O_3 b. HCO_3^- and H_2O

c. HCO_3^- and H_3O^+ d. H_2CO_3 and H_2O

46. Which of the following is reduction?

a. $CO \longrightarrow CO_2$ b. $VO^+ \longrightarrow V_2(SO_4)_3$

c. $MnO_4^- \longrightarrow MnO_4^{-2}$ d. $CrCl_3 \longrightarrow Cr_2(SO_4)_3$

47. The correct order of increasing radii of the ions Br^-, F^-, O^{2-} and S^{2-} is as follow

a. $Br^- < F^- < O^{2-} < S^{2-}$ b. $S^{2-} < O^{2-} < F^- < Br^-$

c. $F^- < O^{2-} < S^{2-} < Br^-$ d. $F^- < Br^- < O^{2-} < S^{2-}$

48. The carbon- carbon bond length is maximum in

a. Ethane b. ethene

c. ethyne d. equal in all

49. We ..... planned the party.

a. herself b. ourselves

c. yourselves d. myself

50. Which one of the following is correct? [IOE 2078]

a. The earth with other planets is (something I forgot). b. The earth with other planets are.....

c. The earth with other planets have..... d. none

51. There are 1000 grams _____ one kilogram.

a. in b. at

c. on d. by

52. 'I sent her a gift.' The equivalent sentence pattern is [IOE 2077]

a. S+V+O b. S+V+IO+DO

c. S+V+DO+IO d. S+V+O+C

53. When he braked the cycle.....

a. Stopped b. to stop

c. had stopped d. stops

54. The passive for 'Do you eat bread?' is _____?

a. Bred was eaten by you b. Bread is eaten by you

c. Bred has been eaten by you d. Is bread eaten by you ?

55. The phonemic transcription of word 'soar' is [IOE 2076]

a. /sɔː(r)/ b. /'sar/

c. /sa(r)/ d. /'sat/

56. "She didn't realize that she was making a mistake." This is a _____ sentence. [IOE 2077]

a. simple b. compound

c. complex d. none of these

57. The government $\underline{\text{put an end}}$ to the violence in the city. underlined word is

a. ended b. inquire

c. search d. examine

58. To convince someone to do something means to.....them. [IOE 2075]

a. suggest b. persuade

c. advice d. recommend

59. They would have done it if they .....

a. know b. Will know

c. had known d. Have known

60. When she was in the university, she _____ wake up early in the morning.

a. should b. would

c. will d. would have

61. The displacement time graph for two bodies A and 'B' arc straight line inclined at 30° and 60° respectively with the time axis. This Ratio of v_A and v_B will be

a. $\sqrt{3}:1$ b. $1:\sqrt{3}$

c. $3:1$ d. $1:3$

62. Two spherical planets A and B having equal mass but densities are in the ratio $8:1$. For these planets, the ratio of acceleration due to gravity at the surface of A to its value at the surface of B is

a. $1:4$ b. $1:2$

c. $4:1$ d. $8:1$

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63. A uniform circular disc, 20 g is rotating about its own vertical axis at 30 rpm. When 20 g sand falls on its surface at distance 5 cm from the center of the disc, the rate of rotation decrease to 24 rpm. Then the radius of the disc should be :

a. $5\ cm$ b. $5\sqrt{2}\ cm$

c. $10\ cm$ d. $20\ cm$

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64. The property of surface tension is obtained in [ ]

a. solid b. liquid

c. gases d. solid, liquid and gases

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65. The ratio of specific heat capacities of a certain gas is 1.4 and density of gas at STP is $90g/\ m^3$. Its specific heat capacity at constant pressure is:

a. $1.44Jg^{-1}K^{-1}$ b. $14.4Jg^{-1}K^{-1}$

c. $1.03Jg^{-1}K^{-1}$ d. $10.3Jg^{-1}K^{-1}$

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66. The minimum distance between an object and its real image formed by a convex lens is [ ]

a. f b. 2f

c. 3f d. 4f

---

67. If a 2 μF condenser is charged to 200 volts and its plates are connected by a wire, the heat produced in the wires is:

a. 4×10^{-4} Joule b. 4×10^{-2} Joule

c. 4×10^{-5} Joule d. 2.5×10^{-2} Joule

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68. An electrical meter of internal resistance 20 Ω gives a full scale deflection when 1 mA current flows through it. The maximum current that can be measured by using three resistors each of 12 Ω in mA is:

a. 10 b. 5

c. 6 d. 4

---

69. A wire 30m long is bent into N turns of circular coil of diameter 15cm forming a solenoid of length 60cm. calculate flux density inside it when a current of 3A passes through it: [IOE 2078]

a. $6.67\times10^{-4}T$ b. $1.67\times10^{-4}T$

c. $3\times10^{-4}T$ d. $4\times10^{-4}T$

---

70. Inductance coil of reactance 25 Ω give off heat at the rate of 10 J / s when it carries a current of 0.5 A. The impedance of coil is:

a. 32 Ω b. 42 Ω

c. 47 Ω d. 52 Ω

---

71. A tuning fork of frequency 480 Hz is used to vibrate a sonometer wire having natural frequency 240 Hz. The wire will vibrate with frequency of

a. 240 Hz b. 480 Hz

c. 720 Hz d. 1441 Hz

---

72. A Radio wave of frequency 840 MHz is sent towards on aeroplane. The frequency of the reflected echo has a frequency 2.8 kHz more than original frequency. The velocity of aeroplane is:

a. 3 km/s
b. 2 km/s
c. 4 km/s
d. 0.5 km/s

---

73. If energy of the photons incident on a particular photosensitive metal be 6.62 Joule and frequency of light be 10^{14} then no photons incident on the metal is: [IOE 2077]

a. 10^{16}
b. 10^{20}
c. 10^{18}
d. 10^{22}

---

74. The ionization potential of helium atom is 24.6 v, the energy required to Ionize it will be

a. $24.6eV$
b. $24.6V$
c. $13.6V$
d. $13.6eV$

---

75. If $f(x) = x^2$ and $g(x) = 3^x$ then the solution set of $g_o f(x) = f_o g(x)$ is:

a. R
b. Z
c. $(0, 2)$
d. $\{0, 2\}$

---

76. If the value of $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$; then:

a. $a \neq b \neq c$
b. $a + b + c = 0$
c. $a = b = c$
d. $a - b - c = 0$

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77. When $\left(\frac{z+i}{z+2}\right)$ is purely imaginary, the locus described by the point z in the Argand diagram is a

a. Circle of radius $\frac{5}{\sqrt{2}}$
b. Circle of radius $\frac{5}{4}$
c. Straight line
d. Parabola

---

78. If a, b, c are in G.P and $a^{(1/x)} = b^{(1/y)} = c^{(1/z)}$ then x, y, z are in

a. H.P
b. A.P
c. G.P
d. none

---

79. $2\left(\frac{a}{n} + \frac{a^3}{3n^3} + \frac{a^5}{5n^5} + \cdots + \infty\right)$

a. $\log_e(n + a)$
b. $\log_e(n - a)$
c. $\log_e(n + a)$
d. $\log_e(n + a) - \log_c(n - a)$

---

80. Number of solution of the number of equation $\operatorname{cosec}\theta - \cot\theta = 1$ in $[0, 2\pi]$ is

a. 4
b. 3
c. 2
d. 1

---

81. In triangle ABC, angles A,B and C are on AP. If $b : c = \sqrt{3} : \sqrt{2}$, Find A. [IOE 2078]

a. 30°
b. 60°
c. 45°
d. 75°

---

82. If $|\vec{a}| = |\vec{b}| = 3, |\vec{a} + \vec{b}| = 3$ then $(3\vec{a} + 2\vec{b}) \cdot (2\vec{a} - 5\vec{b})$ is [IOE 2078]

a. -10
b. -19.5
c. 46.5
d. 13.5

83. The value of 'r' when the line joining origin and point of intersec tion of $x + y = 2$ and $x^2 + y^2 = r^2$ are at right angles [IOE 2075]

a. ± 4
b. ± 1
c. ± 3
d. ± 2

84. If $lx + my = 1$ tangent to $x^2 + y^2 = a^2$, the point (l, m) lies on circle [IOE 2074]

a. $x^2 + y^2 = a^2$
b. $x^2 + y^2 = \frac{1}{a^2}$
c. $x^2 + y^2 = 2a^2$
d. $x^2 + y^2 = \frac{1}{2a^2}$

85. The axis of parabola $2x^2 - 20x - y + 53 = 0$ is [IOE 2075]

a. $x = 5$
b. $y = 5$
c. $x = -5$
d. $y = -5$

86. If $OP =< 3, 1, -3 >$ $OQ =< 4, -2, 1 >$ the direction cosines of PQ are: [IOE 2078]

a. $\frac{1}{\sqrt{26}}, -\frac{3}{\sqrt{26}}, \frac{4}{\sqrt{26}}$
b. $\frac{1}{\sqrt{26}}, \frac{3}{\sqrt{26}}, \frac{4}{\sqrt{26}}$
c. $\frac{1}{\sqrt{26}}, \frac{3}{\sqrt{26}}, -\frac{4}{\sqrt{26}}$
d. $-\frac{1}{\sqrt{26}}, \frac{3}{\sqrt{26}}, \frac{4}{\sqrt{26}}$

87. $\lim_{x \to 0} x \sin(\frac{1}{x})$ [IOE 2078]

a. 0
b. 1
c. 2
d. Doesnt exist

88. If $x = a\cos t, y = a\sin t$ then $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$ is [IOE 2075]

a. $\frac{a}{2\sqrt{2}}$
b. $\frac{2\sqrt{2}}{a}$
c. $-\frac{a}{2\sqrt{2}}$
d. $-\frac{2\sqrt{2}}{a}$

89. $\int \tan \sin^{-1} x dx =$ [IOE 2075]

a. $\sqrt{1-x} + c$
b. $(1 - x^2) + c$
c. $-(1 - x^2) + c$
d. $-\sqrt{1 - x^2} + c$

90. Which of the following is the most stable alkene?

a. $\mathrm{CH_2 = CH_2}$
b. $\mathrm{R_2\ C = CR_2}$
c. $\mathrm{RCH_2 = CH_2\ R}$
d. $\mathrm{RCH = CHR}$

91. The acid employed for etching glass is

a. $\mathrm{H_2SO_4}$
b. $\mathrm{HClO_4}$
c. HF
d. Aqua regia

92. Purification of aluminium by electrolytic process is known as

a. Hoope's process
b. Serpeck's process
c. Hall's process
d. Bayer's process

93. Approximate atomic mass of an elements is 26.89. If its equivalent mass is 8.9, the exact atomic mass of element

would be

a. 23.41 b. 29.12

c. 26.7 d. 12.12

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94. The wt. of $BaCl_2$ that must be dissolved in 200 ml solution to produce chloride ion concentration at that present in solution containing 5.85gm NaCl per 100ml is : (Ba=137) .

a. 20.8gm b. 10.4gm

c. 41.6gm d. 10.4gm

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95. The solubility product of SrF_2 in water is 8×10^{-10}. The solubility of $0.1M\ NaF$ aqueous solution will be [IOE 2077]

a. $9 \times 10^{-9} mole/L$ b. $8 \times 10^{-8} mole/L$

c. $5 \times 10^{-4} mole/L$ d. $4 \times 10^{-6} mole/L$

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96. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milliampere current. The time required to liberate 0.01 mole of H_2 gas at the cathode is

a. 9.65×10^4 sec b. 19.3×10^4 sec

c. 28.95×10^4 sec d. 38.6×10^4 sec

Read the following passage carefully, and find out the correct answers for the questions given below.
(Questions from 97 to 100)

It was in Germany and France that the first successful attempts were made to produce an internal-combustion engine driven by petrol. In England people were strangely timid about horseless vehicles. English inventors were handicapped by a quaint old law which forbade any such vehicle to attain a greater speed than four miles an hour, and compelled each one to be preceded by a man carrying a red flag. This law was not repealed until 1896.

The earliest motor cars were looked upon as mere jokes, or as rather dangerous playthings, by every one except their inventors. Some of them were single-seaters, others would carry two or even three people; but all were noisy, clumsy, queer-looking things. When in 1888, Carl Benz, a German, produced a three-wheeled, internal-combustion car, a great forward stride had been made. Another German, whose name, Daimler, is often seen on motor cars to this day; was experimenting about the same time, and testing a petrol- driven engine.

It is easy to understand how the introduction of the petrol- driven engine revolutionized road transport throughout the world. Until then the necessary power to push a vehicle along could not be obtained without the cumbersome tanks and boilers and furnaces of the steam engine. The

internal- combustion engine is light in weight and small in size by comparison; the fuel is burned in it, so that there is no waste, like the dusty cinders of a coal-fire.

97. How did most people regard early motor cars?

a. Not better than horse-driven vehicles.
b. A mere joke, or as rather dangerous playthings.
c. A mere scientific experiment.
d. A cumbersome vehicle.

98. What made the English inventors handicapped?

a. General public did not welcome the invention.
b. The quaint old law, which forbade any such vehicle to attain a greater speed than four miles/hour.
c. Non-availability of adequate fuel to power the engine.
d. None of these.

99. What does 'repealed' mean? [ ]

a. repeated
b. abolished
c. contradicted
d. enforced

100. Which among the following words is as nearly opposite meaning to 'clumsy' used in the passage?

a. unhandy
b. refined
c. unusually large
d. unusual

Answer Key

1.c	2.d	3.a	4.a	5.c	6.d	7.d	8.c
9.c	10.a	11.c	12.d	13.a	14.c	15.a	16.c
17.c	18.d	19.a	20.d	21.b	22.c	23.a	24.d
25.c	26.b	27.b	28.d	29.c	30.d	31.a	32.a
33.b	34.d	35.a	36.d	37.c	38.a	39.a	40.a
41.a	42.b	43.b	44.a	45.b	46.c	47.c	48.a
49.b	50.b	51.a	52.b	53.a	54.d	55.a	56.c
57.a	58.b	59.c	60.b	61.d	62.c	63.c	64.b
65.b	66.d	67.a	68.c	69.a	70.c	71.b	72.d
73.b	74.a	75.d	76.c	77.a	78.b	79.d	80.d
81.d	82.d	83.d	84.b	85.a	86.a	87.a	88.d
89.d	90.b	91.c	92.a	93.c	94.a	95.b	96.b
97.b	98.`	99.b	100.b				

Solutions

1. c

Mean time period $T = 2.00$ sec & Mean absolute error $= \Delta T = 0.05$ sec.

To express maximum estimate of error, the time period should be written as (2.00 ± 0.05) sec

2. d

$W = mg + W_b = 64 \times 9.8 + 6 = 633.2N$

3. a

$g = \frac{GM}{R^2}$

$g \propto \frac{1}{R^2}$

4. a

Applying parallel axis theorem ,

$I = I_0 + Md^2$

$= \frac{ML^2}{12} + M(\frac{L}{4})^2$

$= \frac{ML^2}{12} + \frac{ML^2}{16}$

$= \frac{7}{48}ML^2$

5. c

$\frac{4T}{r_1} = 3 \times \frac{4T}{r_2}$

$r_2 = 3r_1$

$\frac{V_1}{V_2} = (\frac{r_1}{r_2})^3 = \frac{1}{27}$

6. d

$S = \frac{Q}{m\Delta\theta}$

For adiabatic process, Q=0 and hence S=0.

7. d

Adiabatic process − sudden process, where Q = constant

or, $\Delta Q = 0$

and there is decrease in internal energy

8. c

Let the distance of image from second focus be y , then from Newton's :

$xy = f^2 \rightarrow y = \frac{f^2}{x}$

$m = \frac{I}{O} = \frac{v}{u} = \frac{f+y}{f+x} = \frac{f+\frac{f^2}{x}}{x}$

$= \frac{fx+x^2}{x} \times \frac{1}{f+x} = \frac{f(x+f)}{x(f+x)} = \frac{f}{x}$

9. c

As μ is greater fro denser medium and less for rarer medium .

v$\propto \frac{1}{\mu}$

Thus velocity of light increases in rarer medium .

10. a

Radius of big drop $R = 2r$

[$\frac{4}{3}\pi R^3 = 8 \times \frac{4}{3}\pi r^3$]

As, $C = 4\pi\epsilon_o R ; C \alpha R$

Capacitance of big drop (C) = 2C .

Big Drop	Small Drop
Q	nq
R	$n^{1/3}r$
C	$n^{1/3}C$
σ	$n^{1/3}\sigma$
U' (P.E)	$n^{5/3}U$

$$C' = n^{\frac{1}{3}} C = 8^{\frac{1}{3}} C = 2C$$

11. c

$\theta_i = 600\ K = 600 - 273 = 327^\circ C$

$\theta_n = 210^\circ C$

$\theta_c = \dfrac{\theta_c + \theta_i}{2}$

or, $210 = \dfrac{\theta_c + 327}{2}$

i.e., $\theta_c = 93^\circ C$

12. d

$W = MB\left(\cos\theta_1 - \cos\theta_2\right)$

$\theta_1 = 0^\circ,\ \theta = 180^\circ$

$W = MB\left(\cos 0^\circ - \cos 180^\circ\right)$

$= MB\left[1 - (-1)\right]$

$W = \Delta K \cdot E = 2MB$

13. a

$$R = \frac{E - V}{l} = \frac{120 - V}{10} = 5$$

At the time of switch off, E=0

$$\therefore I = \frac{V}{R} = \frac{115}{0.5} = 230A$$

14. c

We know that $y_n = \dfrac{n\lambda D}{d}$

$\lambda \propto \dfrac{1}{n}$

$\dfrac{\lambda}{\lambda_2} = \dfrac{n_2}{n_1}$

$\dfrac{600}{400} = \dfrac{n_2}{12}$

$n_2 = 18$

15. a

n–$200 = 5$.....(1)

420–$2n = 10$..... (2)

Solving eq. (1) and (2);$n = 205$ Hz

16. c

17. c

18. d

For any element in domain A, it has two images in range.

Example: For $x = 3 \in A, f = \pm 6$

19. a

It is a fundamental concept.

20. d

$\arg(z) + \arg(\bar{z}) = 0$ or $2n\pi$

21. b

$\frac{2}{1!} + \frac{2+4}{2!} + \frac{2+4+6}{3!} + \ldots\ldots\infty$

$$t_n = \frac{n(n+1)}{n!} = \frac{n(n+1)}{n(n-1)!}$$

$$= \frac{n-1+2}{(n-1)!}$$
$$= \frac{n-1}{(n-1)!} + \frac{2}{(n-1)!}$$
$$= \frac{1}{(n-2)!} + \frac{2}{(n-1)!}$$
$$= \frac{1}{(n-2)!} + \frac{2}{(n-1)!}$$

Applying summation,

$$= \sum \left[\frac{1}{(n-2)!} + \frac{2}{(n-1)!} \right]$$
$$= \mathrm{e} + 2\mathrm{e} = 3\mathrm{e}$$

22. c

$4\sin^{-1}(x) + \cos^{-1}(x) = \pi$

$3\sin^{-1}(x) + \sin^{-1}(x) + \cos^{-1}(x) = \pi$

$3\sin^{-1}(x) + \frac{\pi}{2} = \pi$

$3\sin^{-1}(x) = \frac{\pi}{2}$

$\sin^{-1}(x) = \frac{\pi}{6}$

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

23. a

$\cos\left[\tan^{-1}\left(\frac{3}{4}\right)\right]$

Let $\tan^{-1}\frac{3}{4} = x \rightarrow \tan x = \frac{3}{4}$

$\cos x = \frac{1}{\sec x} = \frac{1}{\sqrt{1+\tan^2 x}} = \frac{1}{\sqrt{1+(\frac{3}{4})^2}} = \frac{4}{5}$

$x = \cos^{-1}\frac{4}{5}$

$$\cos\left[\tan^{-1}\left(\frac{3}{4}\right)\right]$$

$\cos x$

$$\cos[\cos^{-1}\frac{4}{5}] = \frac{4}{5}$$

24. d

$a\cot A + b\cot B + c\cot C$

$$a\frac{\cos A}{\sin A} + b\frac{\cos B}{\sin B} + c\frac{\cos C}{\sin C}$$

We know:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

$$= 2R\cos A + 2R\cos B + 2R\cos C$$

$$= 2R(\cos A + \cos B + \cos C)$$

$$= 2R(1 + 4\sin(\frac{A}{2})\sin(\frac{B}{2})\sin(\frac{C}{2}))$$

$$= 2R(1 + \frac{r}{R})$$

$$= 2(R + r)$$

25. c

$|\hat{a} - \hat{b}| = \sqrt{a^2 - 2\hat{a}\hat{b} + b^2} = \sqrt{1 - 2ab\cos\theta + 1} =$
$\sqrt{1 - 2\cos\theta + 1} = \sqrt{2(1 - \cos\theta)} = \sqrt{4\sin^2\frac{\theta}{2}} = 2\sin\frac{\theta}{2}$

26. b

Distance between parallel lines $=2\sqrt{\frac{g^2 - ac}{a(a+b)}} =$
$2\sqrt{\frac{(-3)^2 - 8}{1(1+1)}} = \sqrt{2}$

27. b

Radius of circle touching x-axis = $|\text{y-coordinate}|$ = 4

Equation of circle is $(x-3)^2 + (y+4)^2 = 4^2$

28. d

$(y - \text{a})^2 = 4a(x - a)$

Comparing with standard equation of parabola.

$(y-k)^2 = 4a(x-h)$

$h = a, k = a$

29. c

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1(b > a)$: Latus rectum = $\frac{2a^2}{b}$

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1(b < a)$: Latus rectum = $\frac{2b^2}{a}$

30. d

Projection = length of line * cosine of angle between lines =

$\sqrt{(4-1)^2+(5-2)^2+(6-3)^2} \times \frac{\sqrt{3}}{2} = 9/2$ units

31. a

32. a

33. b

$$\text{Let } y = f(x) = (x+2)$$
$$f(f(x)) = f(x+2)$$
$$= (x+2)+2 = (x+4)$$

Now differentiating we get,

$$f'(f(x)) = 1 \quad (\text{at } x = 4)$$

34. d

$f(x) = mx + c$

$f'(x) = m < 0$ For strictly decreasing

$m < 0$

35. a

$2(l+b) = 100$

$l + b = 50$

$l = 50 - b$

$A = lb$

$A = b(50-b) = 50b - b^2$

$\frac{dA}{db} = 50 - 2b$

$0 = 50 - 2b$

$b = 25$

When $b = 25, l = 25$

36. d

$f'(x) = 3x^2 - \frac{2}{x}$

$f(x) = x^3 + \frac{2}{x^2} + c$

$f(1) = 3 + c$

$c = -3$

$f(x) = x^3 + \frac{2}{x^2} - 3$

$\int f(x)dx = \frac{x^4}{4} - \frac{4}{x^3} - 3x$

37. c

38. a

$$C_6H_6 \xrightarrow[H_2SO_4]{HNO_3} C_6H_5NO_2$$

39. a

A carbocation is an ion with a positively-charged carbon atom.

eg. CH_3^+

In carbocation, the hybridization of carbon will be sp^2 and its shape is trigonal planar. There is also a vacant p orbital which indicates its electron-deficient nature. The carbon has 6 electrons in its valence shell.

40. a

Nitric acid has a yellowish-brownish colour due to the presence of gaseous nitrogen oxides dissolved in it. The eminent nitrogen oxide which imparts yellow colour to the otherwise colourless solution of nitric acid is nitrogen dioxide.

41. a

Out of F, Cl and Br, Fluorine is the most reactive because the chemical reactivity of non-metals decreases on going down in a group of the periodic table as moving down in a group of non-metals, the size of the atoms goes on increasing.

42. b

$NaOH$ absorbs the molecule present in air and leads to the decrease in strength of the solution.

43. b

Copper obtained after poling is called tough cake copper which is 99% pure.

44. a

Carbon is the chief element present as an impurity in Pig iron.

45. b

Amphoteric behaviour is that any species which acts as an acid as well as base.

$$\underset{\text{Acid}}{HCO^{-3}} \longrightarrow {CO_2}^{-3} + H^+$$

$$\underset{\text{Base}}{HCO^{-3}} + H^+ \longrightarrow H_2CO_3$$

$$\underset{\text{Acid}}{H_2O} \longrightarrow H^+ + OH^-$$

$$\underset{\text{Base}}{H_2O} + H^+ \longrightarrow H_3O^+$$

46. c

For (a)
At LHS, $x + (-2) = 0 \rightarrow x = +2$
At RHS, $x + 2 \times (-2) = 0 \rightarrow x = +4$
Hence, oxidation.
For (b)
At LHS, $x + (-2) = +1 \rightarrow x = +3$
At RHS, $2x + 3 \times (-2) = 0 \rightarrow x = +3$
Hence, no oxidation reduction.
For (c)
At LHS, $x + 4 \times (-2) = -1 \rightarrow x = +7$
At RHS, $x + 4 \times (-2) = -2 \rightarrow x = +6$
Hence, reduction.
For (d)

Chromium on both sides has O.N. $+3$. Hence no oxidation reduction

47. c

While going down the group radii increases (due to the increase in the number of shells) and radii increases toward left of the group due to fewer Zeffective.

48. a

In $C_2H_6, C-C$ bond length is $1.54\mathring{A}$ is the longest.

49. b

50. b

51. a

52. b

53. a

54. d

55. a

56. c

57. a

58. b

59. c

60. b

61. d

$$\frac{v_A}{v_B} = \frac{\tan\theta_1}{\tan\theta_2} = \frac{\tan 30^\circ}{\tan 60^\circ} = 1 \times \frac{1}{\sqrt{3}} \times \sqrt{3} = \frac{1}{3}$$

62. c

we have,

$$g \propto \frac{M}{R^2} \propto \frac{\rho \times \text{ Volume}}{R^2} \propto \rho \times R \ldots (i)$$

Also,

$$\rho \propto \frac{1}{\text{Volume}} \propto \frac{1}{R^3} \ldots (ii)$$

As, $\frac{\rho_1}{\rho_2} = \frac{8}{1}$

$$\frac{R_1}{R_2} = \frac{2}{1}$$

From (i),

$$g \propto \rho \times R$$

Therefore,

$$\frac{g_1}{g_2} = \frac{\rho_1}{\rho_2} \times \frac{R_1}{R_2} = \frac{8}{1} \times \frac{1}{2} = \frac{4}{1}$$

63. c

$I_0F_0 = If$
$I_0 \times 30 = (I_0 + 20 \times 5^2)24$
$or, I_0 = 2000\ gmcm^2$

$\frac{1}{2}MR^2 = I_0$
$\frac{1}{2} \times 40 \times R^2 = 2000$
$\therefore R = \sqrt{100} = 10\ cm$

64. b

65. b

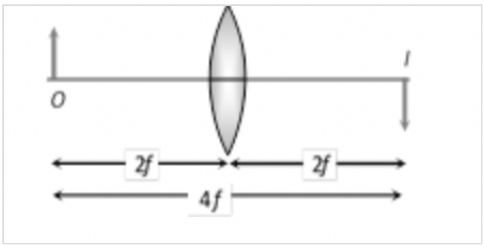
$r = \frac{P_0}{\rho_0 T_0} = \frac{1.01 \times 10^5}{90 \times 273} 4.11 Jg^{-1}k^{-1}$

$C_p - C_v = r$

or, $C_p - \frac{C_p}{\gamma} = r$

or, $C_p = \frac{r}{r-1} \times \gamma = 14.4 Jg^{-1}K^{-1}$

66. d



67. a

Heat produced in wire = energy stored in capacitor

Heat produced in wire = $\frac{1}{2}\mathrm{CV}^2$

Heat produced in wire = $\frac{1}{2} \times 2 \times 10^{-6} \times (200)^2$

Heat produced in wire = $200 \times 200 \times 10^{-6}$

Heat produced in wire = 4×10^{-4} J

68. c

For maximum current the shunt should be least, so all resistance must be in parallel

$S = \frac{12}{3} = 4\Omega$

$I_{max} = \frac{(S+G)i_g}{S} = 6mA$

69. a

$30 = \pi dN$

$N = \frac{30}{3.141 \times 0.15} = 63.67$ turns

$B = \mu_0 ni = \mu_0 \frac{N}{l} i = 6.67 \times 10^{-4} T$

70. c

$P = I^2 R$

$or, R = \frac{10}{0.5^2} = 40\Omega$

$Z = \sqrt{R^2 + X_L^2}$

$= \sqrt{40^2 + 25^2} = 47.1\Omega$

71. b

When a vibrating body (A) with a certain frequency is kept near to another body (B), then B vibrates with the frequency of A.

72. d

$\Delta n = \frac{2v}{c} \times n$

$2.8 \times 10^3 = \frac{2v}{3 \times 10^8} \times 840 \times 10^6$

$v = 500 m/s$

73. b

$E = nh\nu$

$6.62 = n \times 6.62 \times 10^{-34} \times 10^{14}$

$1 = n \times 10^{-20}$

$n = 10^{20}$

74. a

$E = eV_i = 24.6eV$

75. d

$g_o f(x) = g(f(x)) = g(x^2) = 3^{x^2}$

$f_o g(x) = f(g(x)) = f(3^x) = (3^x)^2$

$g_o f(x) = f_o g(x)$

$3^{x^2} = (3^x)^2$

$x^2 = 2x$

$x(x-2) = 0$

$x = \{0, 2\}$

76. c

$\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$

$1(c^2 - ab) - a(c-a) + b(b-c) = 0$

$c^2 - ab - ac + a^2 + b^2 - bc = 0$

$a^2 + b^2 + c^2 - ab - ac - bc = 0$

$\frac{1}{2}[(a-b)^2 + (b-c)^2 + (c-a)^2] = 0$

$(a-b)^2 = 0 \rightarrow a = b$

$(b-c)^2 = 0 \rightarrow b = c$

$(c-a)^2 = 0 \rightarrow c = a$

$a = b = c$

77. a

$\left(\frac{x + i(y+1)}{x + 2 + iy}\right)$

As it is imaginary,

$$\overline{\left(\frac{x+i(y+1)}{x+2+iy}\right)} = -\left(\frac{x+i(y+1)}{x+2+iy}\right)$$

$$\left(\frac{x-i(y+1)}{x+2-iy}\right) = -\left(\frac{x+i(y+1)}{x+2+iy}\right)$$

$x(x+2)+ixy-(y+1)(x+2)i+y(y+1) = -[x(x+2)-xyi+i(y+1)(x+2)+y(y+1)]$

$x(x+2)+ixy-(y+1)(x+2)i+y(y+1) = -x(x+2)+xyi-i(y+1)(x+2)-y(y+1)$

$2x(x+2)+2y(y+1) = 0$

$2x^2+4x+2y^2+2y = 0$

78. b

$a^{(1/x)} = b^{(1/y)} = c^{(1/z)} = k$

$a = k^x$

$b = k^y$

$c = k^z$

a, b, c are in GP

$b^2 = ac$

$k^{2y} = k^x k^z$

$k^{2y} = k^{x+z}$

$x+z = 2y$

x, y, z are in AP

79. d

$$2\left(\frac{a}{n}+\frac{a^3}{3n}+\frac{a^5}{5n^5}+\ldots\ldots\infty\right)$$

$$= 2\left(\frac{a}{n}+\frac{\left(\frac{a}{n}\right)^3}{x}+\frac{\left(\frac{a}{n}\right)^5}{5}+\ldots\ldots\infty\right)$$

$$= 2\cdot\frac{1}{2}\log_e\left(\frac{1+\frac{a}{n}}{1-\frac{a}{n}}\right)$$

$$= \log_e\left(\frac{n+a}{n-a}\right)$$

$= \log_e(n+a) - \log_e(n-a)$

80. d

$\operatorname{cosec}\theta - \cot\theta = 1$

$$\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta} = 1$$

$\sin\theta + \cos\theta = 1$

Dividing by $\sqrt{1^2+1^2} = \sqrt{2}$

$\frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x = \frac{1}{\sqrt{2}}$

$\cos\frac{\pi}{4}\sin x + \sin\frac{\pi}{4}\cos x = \frac{1}{\sqrt{2}}$

$\sin(\frac{\pi}{4} + x) = \sin\frac{\pi}{4}$

$\frac{\pi}{4} + x = n\pi + (-1)^n\frac{\pi}{4}$

$x = n\pi + (-1)^n\frac{\pi}{4} - \frac{\pi}{4}$

putting n= 1, $x = \frac{\pi}{2}$ is only solution on $[0, 2\pi]$

81. d

Let the angles be a,a+d,a+2d.

Then, $a + a + d + a + 2d = 180^\circ$

or, $a + d = 60^\circ$

So $\angle B = 60^\circ$

Now, $\frac{b}{c} = \frac{\sin B}{\sin C} = \frac{3}{2}$

$\Rightarrow \sin C = \sqrt{\frac{2}{3}} \times \frac{\sqrt{3}}{2} = \frac{1}{\sqrt{2}}$

$\Rightarrow C = 45^\circ$

So, $\angle A = 75^\circ$

82. d

83. d

Making $x^2 + y^2 = r^2$ homogenous with help of $x + y = 2$

$x^2 + y^2 + = r^2(x + y/2)^2$

or, $x^2 + y^2 = \frac{r^2}{4}(x^2 + 2xy + y^2)$

or,$(1 - \frac{r^2}{4})x^2 + (1 - \frac{r^2}{4})y^2 - \frac{r^2}{2}xy = 0$

for right angle

coeff. Of x^2+ cooeff. Of $y^2 = 0$

or, $1 - \frac{r^2}{4} + 1 - \frac{r^2}{4} = 0$

$2 - \frac{r^2}{2} = 0$

$r = \pm 2$

84. b

or, $\frac{l \times 0 + m \times 0 - 1}{\sqrt{l^2 + m^2}} = a$

or, $l^2 + m^2 = \frac{1}{a^2}$

clearly, (l,m) lies in $x^2 + y^2 = \frac{1}{a^2}$

85. a

$2x^2 - 20x - y + 53 = 0$

$2(x^2 - 10x) - y + 53 = 0$

Or, $2(x-5)^2 = y - 3$

i.e., $(x-5)^2 = \frac{1}{2}(y-3)$

comparing this with $(x-h)^2 = 4a(y-k) \rightarrow h = 5$ so, axis $x = h$ i.e., $x = 5$

86. a

87. a

88. d

here, $x^2 + y^2 = a^2$ and $y(\frac{\pi}{4}) = \frac{a}{\sqrt{2}}$, $x(\frac{x}{4}) = \frac{a}{\sqrt{2}}$

Differentiating we get,

$2x + 2yy_1 = 0 \Rightarrow y_1 = -\frac{x}{y}$,

so, $y_1(\frac{\pi}{4}) = -1$

Now, $x + yy_1 = 0 \Rightarrow 1 + y_1^2 + yy_2 = 0$

$2 + (\frac{a}{\sqrt{2}})y_2 = 0$

$y_2 = -\frac{2\sqrt{2}}{a}$

89. d

$\int \tan(\sin^{-1} x)dx$

$= \int \tan \tan^{-1}(\frac{x}{\sqrt{1-x^2}})dx = \int \frac{x}{\sqrt{1-x^2}}dx = \frac{1}{2}\int \frac{2x}{\sqrt{1-x^2}}dx$

$-\sqrt{1-x^2} + c$

90. b

We know that greater the number of alkyl groups attached to double-bonded carbon atoms, more stable is the alkene. Therefore most stable is $\mathrm{R_2C{=}CR_2}$

91. c

Glass etching is known as a technique used for creating art on the surface of glass by applying acid, caustic or abrasive substances. The acid which is basically used for the process of glass etching is known as Hydroflouric acid (HF).

92. a

The purification of aluminum by electrolytic refining is known as Hoope's process.

93. c

$$\text{valency} = \frac{26.89}{8.9} = 3.02 \approx 3$$

$$\text{exact atomic wt} = 8.9 \times 3 = 26.7$$

94. a

95. b

$$\mathrm{NaF\ (0.1\,M) \longrightarrow Na^{+}(0.1\,M) + F^{-}(0.1\,M)}$$
$$\mathrm{SrF_2(S) \longrightarrow Sr^{++}(S) + 2\,F^{-}(2\,S)}$$
$$Now, K_{SP} = [Sr^{++}][F^{-}]^2$$
$$or, 8 \times 10^{-10} = S \times (2S + 0.1)^2$$
$$or, 8 \times 10^{-10} = S \times 0.1^2 (\because 0.1 >>> S)$$
$$\therefore S = 8 \times 10^{-8} mole/L$$

96. b

$$\mathrm{2\,H^{+} + 2\,e^{-} \longrightarrow H_2}$$

$$1\,\text{mole} = 2\ \times 96500\,\mathrm{C}$$

$$0.01\,\text{mole} = 1930\,\mathrm{C}$$

$$Q = 1930\ \mathrm{C}$$

$$Q = It$$

$$t = \frac{1930}{0.01} = 193000\ \text{sec}$$

97. b

98. `

99. b

100. b