C- Physics

91. A radioactive nuclide sample has a half-life of 2 days. If 3 kg of the sample remains after 8 days, what was the initial mass of the sample?

A. 15 kg B. 48 kg C. 12 kg D. 9 kg

$$m = \frac{m_0}{2^n} \Rightarrow m_0 = m \times 2^n$$

$$but\ n = \frac{t}{T} = \frac{8}{2} = 4 \Rightarrow m_0 = 3 \times 2^4 = 48kg$$

Correct answer is: B

92. Uranium-235 and Plutonium-239 are used as fuels in nuclear reactors because of their

A. ability to undergo fusion B. inability to absorb neutrons
C. ability to undergo fission D. inability to release neutrons

Plutonium is a fissile nucleus; it undergoes nuclear fission.

Correct answer is: C

93. An opera singer's voice is able to break a thin crystal glass when the singer's voice and the vibrating glass have the same

A. amplitude B. speed C. frequency D. wavelength

The glass should break when it vibrates strongly with maximum amplitude, so glass enters resonance. Thus, sound and glass have same frequency.

Correct answer is: C

94. A step-up transformer is used on a 120V line to furnish 1800V. The primary has 100 turns. How many turns are on the secondary?

A. 1000 B. 1500 C. 2000 D. 300

$$Law\ of\ voltages: \frac{U_2}{U_1} = \frac{N_2}{N_1} \Rightarrow \frac{1800}{120} = \frac{N_2}{100}$$

$$\Rightarrow N_2 = 1500\ turn$$

Correct answer is: B

95. The induced emf in a $150cm^2$ circular coil having 100 turns when the field strength B passing through the coil changes from 0 to 0.001T in 0.1 s at a constant rate is

A. 0.015V B. 0.035V C. -0.015V D. -0.035V

$$induced\ e.m.f: e = -\frac{d\phi}{dt} = -\frac{\Delta\phi}{\Delta t}$$

$$\phi = NBS\cos\theta = NBS \Rightarrow \Delta\phi = \phi_f - \phi_i = NB_fS - NB_iS$$

$$\Rightarrow \Delta\phi = 100 \times 0.001 \times 150 \times 10^{-4} = 1.5 \times 10^{-3} Wb$$

$$\Rightarrow e = -\frac{1.5 \times 10^{-3}}{0.1} = -15 \times 10^{-3} V$$

Correct answer is: C

96. A 16g mass is moving in the +X direction at 0.3m/s while a 4g mass is moving in the -X direction at 0.5m/s. They collide head-on and stick together. Their velocity after collision is

A. 1.4 m/s

B. 14m/s

C. 0.14m/s

D. 1.14m/s

$$\vec{P}_b = \vec{P}_a \Rightarrow m_1\vec{V}_1 + m_2\vec{V}_2 = (m_1 + m_2)\vec{V}$$

$$\Rightarrow m_1V_1 + m_2V_2 = (m_1 + m_2)V \Rightarrow 0.016 \times 0.3 + 0.004(-0.5) = 0.02V$$

$$\Rightarrow V = 0.14m/s$$

Correct answer is: C

97. A series RLC circuit has R =150Ω, L =0.25H and C =16μF. The impedence of this circuit is: (at resonance)

A. 270Ω B. 150Ω C. 166Ω D. 16Ω

$$\text{Im } pedance: Z = \sqrt{R^2 + (L\omega - \frac{1}{C\omega})^2}$$

$$At\ resonance: L\omega = \frac{1}{C\omega} \Rightarrow L\omega - \frac{1}{C\omega} = 0 \Rightarrow Z = R = 150\Omega$$

Correct answer is: B

98. The resonance amplitude of oscillations of a resonator becomes very large if damping is

A. slight

B. medium

C. very high

D. extremely large

At resonance: Damping is slight (little damping)

Correct answer is: A

99. What is the frequency of a photon whose energy is 2.4 eV?

h = 6.6× 10^{-34} J.s

A. 8.00 × 10^{14} hertz

B. 7.00 × 10^{14} hertz

C. 6.00 × 10^{14} hertz

D. 5.00 × 10^{14} hertz

$$Energy\ of\ \ photon: E_{ph} = h\nu,\ where\ \nu: frequency\ (Hz)$$

$$\Rightarrow \nu = \frac{E_{ph}}{h} = \frac{2.4\times1.6\times10^{-19}}{6.6\times10^{-34}} = 5.8\times10^{14}\,Hz\ \ (1eV = 1.6\times10^{-19}\,J)$$

Correct answer is: C

100. X-rays of wavelength 1.37nm incident on an atom cause photoemission of its electrons. If the emitted electrons have energy of 83eV, what is the energy of the level from which the electrons were ejected?

A. 822eV B. 288eV C. -822eV D.-288eV

$$\Rightarrow W_0 = 905 - 83 = 822eV$$

$$\Rightarrow electron\ is\ emitted\ \ from\ level: -822eV$$

Correct answer is: C

$$Einsteins\ relation: E_{ph} = MaxK.E + W_0 \Rightarrow W_0 = E_{ph} - MaxK.E$$

$$E_{ph} = \frac{hc}{\lambda} = \frac{6.62\times10^{-34}\times3\times10^{8}}{1.37\times10^{-9}} = 1.45\times10^{-16}\,J = \frac{1.45\times10^{-16}}{1.6\times10^{-19}} = 905eV$$