PHYSICS

BOOKS - GURUKUL BOOKS & PACKAGING PHYSICS (HINGLISH)

FEBRUARY 2014

Section I

1. Explain the rise of liquid in the capillary on the basis of pressure difference.

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2. Show graphical representation of energy distribution spectrum of perfectly black body.

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3. The escape velocity of a body from the surface of the earth is 11.2 km/s. If a satellite were to orbit close to the surface, what would be its critical velocity ?

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4. A pipe which is opne at both ends is 47 cm long and has an inner diameter 5 cm. If the speed of sound in air is 348 m/s, calculate the fundamental frequency of air column in that pipe.

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5. Show that R.M.S. velocity of gas molecules is directly proportional to square root of its

absolute temperature.

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6. For a particle performing uniform circular motion $\overrightarrow{v} = \overrightarrow{\omega} \times \overrightarrow{r}$. Obtain an expression for linear acceleration of the particle performing non-uniform circular motion.

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7. A stone of mass 1 kg is whirled in horizontal circle attached at the end of a 1 m long string. If the string makes an angle of 30° with vertical, calculate the centripetal force acting on the stone. $\left(g = 9.8 \ \ \mathrm{m/s^2}\right)$.

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8. A solid cylinder of uniform density of radius 2 cm has mass of 50 g. If its length is 12 cm, calculate its moment of inertia about an axis

passing through its centre and perpendicular to its length.

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9. Derive an expression for the acceleration due to gravity at a depth d below the Earth's surface.

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10. A copper metal cube has each side of length 1 m. The bottom edge of the cube is fixed and tangential force 4.2×10^8 N is applied to a top surface. Calculate the lateral displacemet of the top surface if modulus of rigidity of copper is 14×10^{10} $\mathrm{N/m^2}$.

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11. State an expression for K.E. (kinetic energy) and P.E. (potential energy) at displacement 'x'

for a particle performing linear S.H.M. Represent them graphically. Find the displacement at which K.E. is equal to P.E.

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12. The equation of simple harmonic progressive wave is given by $Y = 0.05 \sin \pi \left[20t - \frac{x}{6}\right]$, where all quantities are is S.I. units. Calculate the displacement of a particle at 5 m from origin and at the instant 0.1 second.

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13. State and prove the theorem of 'parallel axis'. Calculate the density of paraffin oil, if glass capillary of diameter 0.25 mm dipped in paraffin oil of surface tension 0.0245 N/m rises to a height of 4 cm. (Angle of contact of paraffin with glass $= 28^\circ$ and acceleration due to gravity $= 9.8 \ \mathrm{m/s^2}$.)

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14. A wire of density $'\rho'$ and Yaung's modulus 'Y' is stretched between two rigid supports separated by a distance 'L' under tension 'T'. Derive an expression for its frequency if fundamental mode. Hence show that $n = \frac{1}{2L}\sqrt{\frac{Yl}{\rho L}}$, where symbols have their usual meanings. When the length of a simple pendulum is decreased by 20 cm, the period changes by $10\,\%$. Find the original length of the pendulum.

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15. The bulging of the earth at the equator and flattening at the poles is due to

A. centripetal force

B. centrifugal force

C. gravitational force

D. electrostatic force

Answer:

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16. The Young's modulus of a wire Y. If the energy per unit volume is E, then the strain will be

A. $\sqrt{\frac{Y}{2E}}$

B. $\sqrt{\frac{E}{Y}}$

C. $\sqrt{\frac{2E}{Y}}$

D. $\sqrt{2EY}$

Answer:

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17. The wavelength range of thermal radiation is

A. from 4000 Å to 7000 Å

B. from 7700 Å to $4 \times 10^6 Å$

C. from $10^6 Å$ to $10^8 Å$

D. from $4 \times 10^{-12} Å$ to $4 \times 10^8 Å$

Answer:

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18. An open pipe resonates to a frequency n_1 and closed pipe to a frequency n_2. If they are joined to form a longer closed pipes , then its fundamental frequency of resonance will be

A. $\frac{n_1 n_2}{2n_2 + n_1}$

B. $\frac{2n_2 n_1}{2n_2 + n_1}$

C. $\frac{2n_2 n_1}{n_1 + n_2}$

D. $\frac{n_2 + 2n_1}{n_1 n_2}$

Answer:

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19. The phase difference between displacement and acceleration of a particle performing S.H.M. is

A. $\frac{\pi}{2}$ rad

B. π rad

C. 2π rad

D. $\frac{3\pi}{2}$ rad

Answer:

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20. Let n_1 and n_2 be the two slightly different frequencies of two sound waves. The time interval between waxing and immediate next waning is

A. $\frac{1}{n_1 - n_2}$

B. $\frac{2}{n_1 - n_2}$

C. $\frac{n_1 - n_2}{2}$

D. $\frac{1}{2(n_1 - n_2)}$

Answer:

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21. A metal ball cools from $64^\circ C$ to $50^\circ C$ in 10 minutes and to $42^\circ C$ in the next 10 minutes. The ratio of the rates of fall of temperature during the two intervals is

A. $\frac{4}{7}$

B. $\frac{7}{4}$

C. 2

D. 2.5

Answer:

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Section Ii

1. Show that the orbital magnetic dipole moment of a revolving electron is $evr/2$.

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2. PHOTOELECTRIC CELL

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3. For a glass plate as a polarizer with refractive index 1.633, calculate the angle of incidence at which light is polarised.

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4. The susceptibiltiy of magnesium at 300 k is 2.4×10^{-5} at what temperature will the susceptibility increase to 3.6×10^{-5}

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5. Draw a neat labelled diagram for Davisson and Germer experiment, for diffraction of electron wave.

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6. Explain the terms : (a) Transmitter and (b) Receiver in communication system.

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7. A metal rod $\frac{1}{\sqrt{\pi}}$ m long rotates about one of its ends in a plane perpendicular to a magnetic field of induction $4 \times 10^{-3} T$. If the emf induced between the ends of the rod is 16 mv, then the number of revolutions made by the rod per second is

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8. Find the wave number of a photon having an energy of 2.072 eV.

Given :

Charge on electron $= 1.6 \times 10^{-19} C$

Velocity of light air $= 3 \times 10^{8} \ \mathrm{m/s}$

Planck's constant $= 6.63 \times 10^{-34}$ J-s.

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9. State Ampere's circuital law. Obtain an expression for magnetic induction along the axis of toroid.

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10. Calculate the radius of second Bohr orbit in hydrogen atom from the given data.

Mass of electron $= 9.1 \times 10^{-31}$ kg

Charge on the electron $= 1.6 \times 10^{-19} C$

Planck's constant $= 6.63 \times 10^{-34}$ J-s.

Permittivity of free space $= 8.85 \times 10^{-12} \mathrm{C}^2 / \mathrm{Nm}^2$.

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11. Explain the working of p-n junction diode in forward and reverse biased mode.

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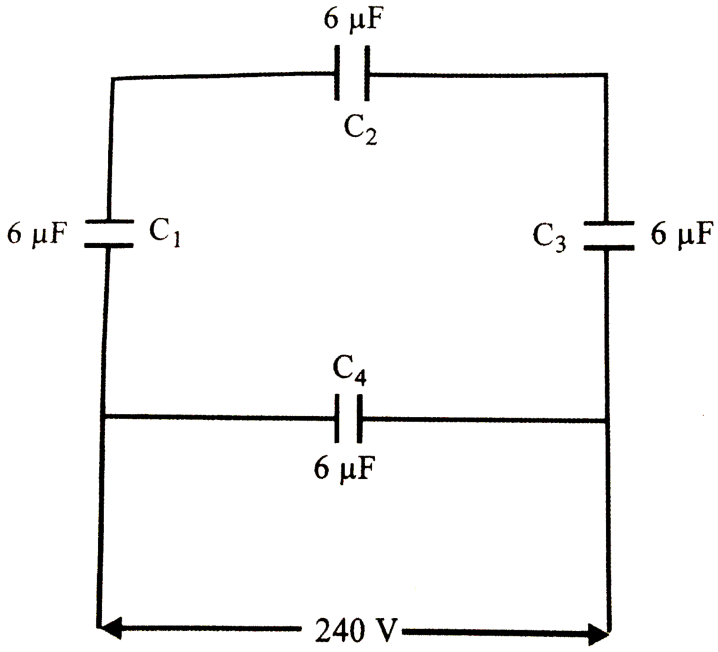
12. A network of four capacitors of 6 μF each is connected to a 240 V supply. Determine the

charge on each capacitor.



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13. Describe biprism experiment to find the wavelength of monochromatic light. Draw the

necessary ray diagram for magnified and diminished images of virtual sources. If the difference in velocities of light in glass and water is $2.7 \times 10^7 \mathrm{m/s}$, find the velocity of light in air.

$$\begin{pmatrix} \text{Refractive index of glass} = 1.5 \\ \text{Refractive index of water} = 1.333 \end{pmatrix}$$

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14. State the principle of a transformer. Explain its construction and working. Derive an expression for the ratio of e.m.f's in terms of

number of turns in primary and secondary coil.

Two diametrically opposite points of a metal ring are connected to two terminals of the left gap of meter bridge. The resistance of 11Ω is connected in right gap. If null point is obtained at a distance of 45 cm from the left end, find the resistance of metal ring.

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15. The intensity of the electric field at a pont close but outside a charged conducting

cylinder is proportional to (r is the distance of the point from the axis of the cylinder)

A. $\frac{1}{r}$

B. $\frac{1}{r^2}$

C. $\frac{1}{r^3}$

D. r^3

Answer:

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16. In p-type semiconductor holes move in

A. extra electron in valence band

B. extra electron in conduction band

C. missing electron in valence band

D. missing electron in conduction band

Answer:

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17. The outermost layer of the Earth's atmosphere is

A. stratosphere

B. mesosphere

C. troposphere

D. ionosphere

Answer:

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18. The accuracy of a potentiometer can be easily increased by

A. increasing resistance of wire

B. decreasing resistance of wire

C. increasing the length of wire

D. decreasing the length of wire

Answer:

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19. When the elecrton in the hydrogen atom jupms from $2nd$ orbit to 1st orbit, the wavelength of radiation emitted is λ. When the electrons jupms from $3rd$ orbit to $1st$ orbit, the wavelength of emitted radiation would be

A. $\frac{27}{32}\lambda$

B. $\frac{32}{27}\lambda$

C. $\frac{2}{3}\lambda$

D. $\frac{3}{2}\lambda$

Answer:

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20. Why should the resistance of an ideal voltmeter be infinite and of ideal ammeter be zero?

A. low resistance

B. high resistance

C. infinite resistance

D. zero resistance

Answer:

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21. What is the resolving power of a telescope of aperture 100 cm, for light of wavelength $5.5 \times 10^{-7} m$?

A. $0.149 \times 10^{+7}$

B. $1.49 \times 10^{+7}$

C. $14.9 \times 10^{+7}$

D. $149 \times 10^{+7}$

Answer:

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