PHYSICS

BOOKS - KVPY PREVIOUS YEAR

MOCK TEST 6

Exercise

1. Let $P(r) = \frac{Q}{\pi R^4} r$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point 'p' inside the

sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is:

A. $\frac{Q}{4\pi\varepsilon_0 r_1^2}$

B. $\frac{Qr_1^2}{4\pi\varepsilon_0 R^4}$

C. $\frac{Qr_1^2}{3\pi\varepsilon_0 R^4}$

D. 0

Answer:

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2. A student measures the thickness of a human hair by looking at it through a microscope of magnification 100. He makes 20 observations and findsd that the average width of the hair in the field of view of the microscope is 3.5mm. What is his estimate on the thickness of hair?

A. 0.035mm

B. 2mm

C. 0.5mm

D. 1.5mm

Answer:

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3. A ray of light moving in air strikes at origin at grazing angle and then follows a path $2y = x^2$ for $x \geq 0$. The correct variation of refractive index with x co-ordinate is:

A. $\sqrt{1 + 4x^2}$

B. $\sqrt{1+2x^2}$

C. $\sqrt{1+x^2}$

D. $\sqrt{1+\frac{x^2}{2}}$

Answer:

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4. The eccentricity of the earth's orbit is 0.0167 , the ratio of its maximum speed in its orbit to its minimum speed is

A. 2507

B. 1033

C. 8324

D. 9000

Answer:

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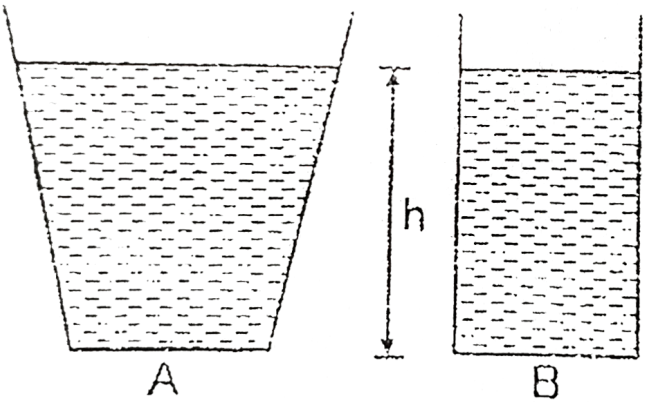
5. Two vessels A and B of different shapes have the same base area and are filled with water up to the same height h (see figure).

The force exerted by water on the base is F_A for vessel A and F_B for vessel B. The respective weights of the water filled in vessels are W_A and W_B. Then



A. $F_A > F_B, W_A > W_B$

B. $F_A = F_B, W_A > W_B$

C. $F_A = F_B, W_A < W_B$

D. $F_A > F_B, W_A = W_B$

Answer:

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6. When the diffraction pattern from a certain slit illuminated with laser light ($\lambda = 6330A^\circ$) is projected on a screen 150 cm from the slit, the second minima on each side are separated by 8 cm. This tells us that:

A. the slit is approximately 0.005 cm wide

B. the slit is approximately 0.05 cm wide

C. a/λ is approximately 7.5 (a is the slit width)

D. a/λ is approximately 750

Answer:

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7. What is the moment of inertia of a ring about a tangent to the periphery of the ring?

A. $\frac{1}{2}MR^2$

B. $\frac{3}{2}MR^2$

C. MR^2

D. $MR^2/9$

Answer:

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8. A particle moves with a velocity $(3i + 4j)$ m/s from origin.The displacement of particle along line x=y after two seconds will be:

A. 10m

B. $\frac{7}{\sqrt{2}}$

C. $7\sqrt{2}m$

D. None of these

Answer:

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9. Hydrogen (H), deuterium (D), singly ionized helium $\left(He^{+}\right)$ and doubly ionized lithium (Li) all have one electron around the

nucleus. Consider $n = 2$ to $n = 1$ transition. The wavelength of emitted radiations are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively. then approximately

A. $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$

B. $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

C. $\lambda_1 = 2\lambda_2 = 2\sqrt{2}\lambda_3 = 3\sqrt{2}\lambda_4$

D. $\lambda_1 = \lambda_2 = 2\lambda_3 = 3\sqrt{2}\lambda_4$

Answer:

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10. The moment of inertia of a uniform thin rod of length L and mass M about an axis passing through a point at a distance of $\frac{L}{3}$ from one of its ends and perpendicular to the rod is

A. $\frac{ML^2}{12}$

B. $\frac{ML^2}{9}$

C. $\frac{7ML^2}{48}$

D. $\frac{ML^2}{48}$

Answer:

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11. A charge q is uniformly distributed on a non-conducting disc of radius R. It is rotated with an angular speed ω about an axis passing through the centre of mass of the disc and perpendicular to its plane. Find the magnetic moment of the disc.

A. $\frac{\mu_0 Q\omega}{2\pi R}$

B. $\frac{\mu_0 Q\omega}{\pi R}$

C. $\frac{\mu_0 Q\omega}{4\pi R}$

D. $\frac{2\mu_0 Q\omega}{\pi R}$

Answer:

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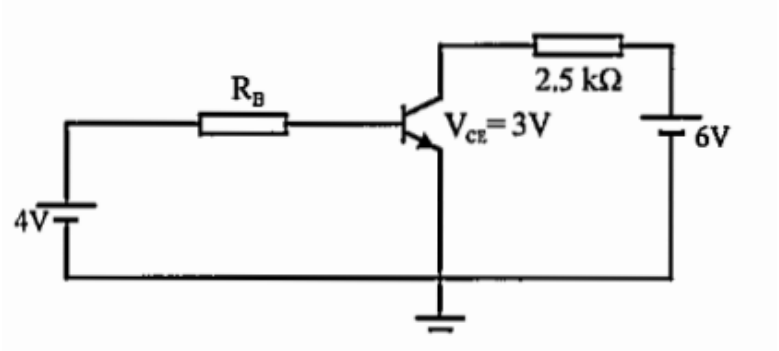
12. Refer to the common emitter amplifier circuit shown below, using a transistor with $\beta = 80$ and $V_{BE} = 0.7$ volt. The value of

resistance R_B is



A. 330Ω

B. $330k\Omega$

C. 220Ω

D. $220k\Omega$

Answer:

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13. If the length of a tube is less and cannot accommodate the maximum rise of liquid, then:

A. liquid will form fountain

B. liquid will not rise

C. the meniscus will adjust itself so that the water does not spill

D. None of these

Answer:

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14. A square wire loop with 2 m sides in perpendicular to a uniform magnetic field, with half the area of the loop in the field. The loop contains a 20 V battery with negligible internal resistance. If the magnitude of the field varies with time according to $B = 0.042 - 0.87$ t, with B in tesla & t in sec. What is the total emf in the circuit ?

A. 20.0V

B. 18.26V

C. 21.74V

D. None of these

Answer:

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15. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β, to come to rest. If the total time elapsed is t seconds.

Then evalute (a) the maximum velocity reached and (b) the total distance travelled.

A. $\frac{\alpha + \beta t^2}{(\alpha + \beta)}$

B. $\frac{\alpha \beta t^2}{2(\alpha + \beta)}$

C. $\frac{\alpha^2 t}{(\alpha + \beta)}$

D. $\frac{\beta^2 t^2}{2(\alpha + \beta)}$

Answer:

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16. Suppose Earth's orbital motion around the Sun is suddenly stopped. What time will the Earth take to fall into the Sun?

A. 2 months

B. 2 years

C. 2 days

D. 20 days

Answer:

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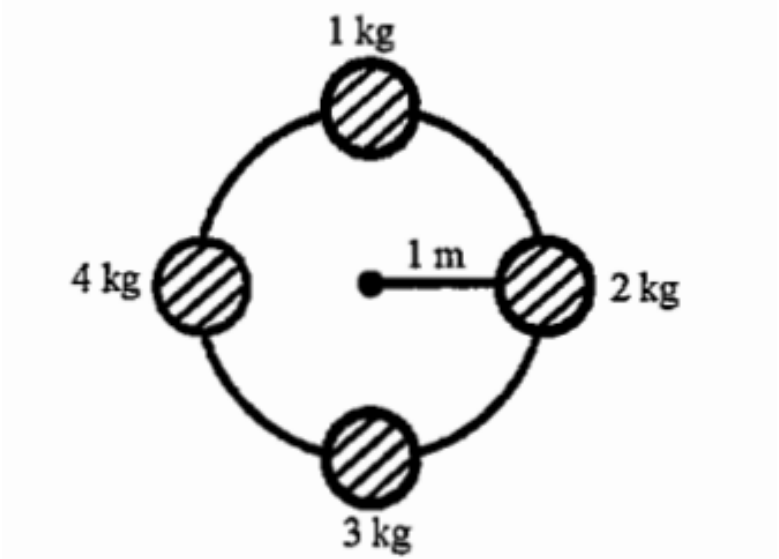
17. Four balls each of radius 10 cm and mass 1 kg,2 kg,3 kg and 4kg are attached to the periphery of massless plate of radius 1m. What is moment of inertia of the system about the centre of plate?



A. $8.08kg/m^2$

B. $7.02kg/m^2$

C. $10.04kg/m^2$

D. $9.02kg/m^2$

Answer:

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18. A particle of mass m moving with kinetic energy K, makes a head - on elastic collision with a stationary particle of mass ηm. The

maximum potential energy stored in the system during the collision is

A. k/n

B. $\frac{(n-1)k}{n}$

C. $\frac{(n+1)k}{n}$

D. $\frac{nk}{(n+1)}$

Answer:

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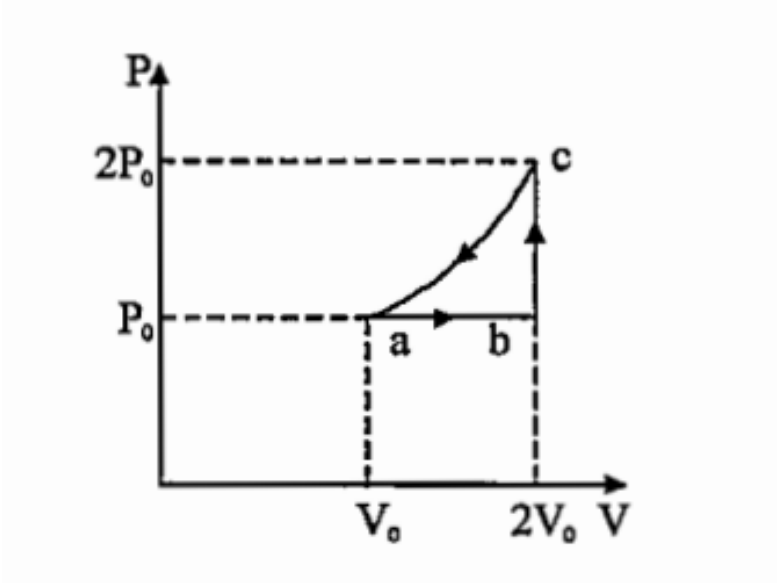
19. One mole of an ideal monatomic gas has initial temperature T_0, is made to go through the cycle abca shown in the given figure.If U denotes the internal energy, then choose the correct alternative.



A. $U_c > U_b > U_a$

B. $U_c - U_b = 5RT_0$

C. $U_c - U_a = \frac{9RT_0}{4}$

D. $U_b - U_a = \frac{3RT_0}{4}$

Answer:

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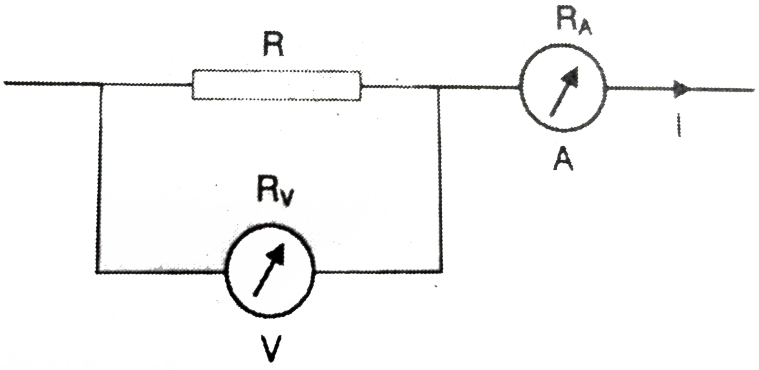
20. Let V and I be the readings of the voltmeter and the ammeter respectively as shown in the figure. Let R_V and R_A be

their corresponding resistancce Therefore,



A. $R = \frac{V}{I}$

B. $R = \frac{V}{I - \left(\frac{V}{R_V}\right)}$

C. $R = R_V - R_A$

D. $R = \frac{V(R + R_A)}{IR_A}$

Answer:

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21. A freshely prepared radioactive source of half 2 hours emits radiations of intensity which is 64 times the permissible safe level. The minimum time after which it would be possible to work safely with this source is a)6 hours b)12 hours c)24 hours d)128 hours

A. 6 hours

B. 12 hours

C. 24 hours

D. 128 hours

Answer:

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22. A large cylindrical rod of length L is made by joining two identical rods of copper and steel of length $\left(\frac{L}{2}\right)$ each. The rods are completely insulated from the surroundings. If the free end of copper rod is maintained at $100^{\circ}C$ and that of steel at $0^{\circ}C$ then the

temperature of junction is (Thermal conductivity of copper is 9 times that of steel)

A. $90^\circ C$

B. $50^\circ C$

C. $10^\circ C$

D. $67^\circ C$

Answer:

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