PHYSICS

BOOKS - MTG PHYSICS (BENGALI ENGLISH)

QUESTION PAPER 2017

Physics

1. Radon-222 has a half- life of 3.8 days. If one starts with 0.064 kg of Radon-222. the quantitiy of Radon-222 left after 19 days will be

A. $0.002kg$

B. $0.062kg$

C. $0.032kg$

D. $0.024kg$

Answer:

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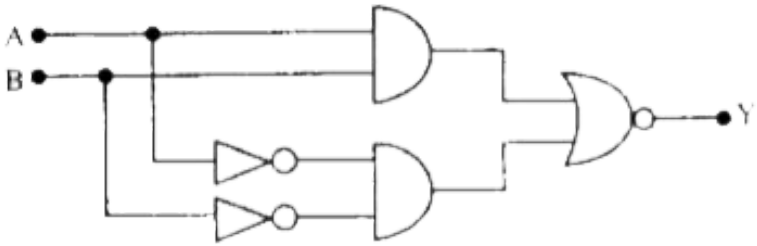
2.



In the given circuit, the binary inputs at A and B are both I in one case and both 0 in the next case. The respetive outputs at Y in these two cases will be :

A. 1,1

B. 0,0

C. 0,1

D. 1,0

Answer:

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3. When a semiconducting device is connedted in series with a battery and a resistance. A current is found to flow in the circuit. If however, the polarity of the battery is reversed. Practivally no current flows in the circuit. The decise may be

A. a p-type semiconductor

B. a n-type semiconductor

C. an intrinsic semiconductor

D. a p-n junction

Answer:

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4. The dimension of the universal constant of gravitation G. is

A. $\left[ML^2 - T^{-1}\right]$

B. $\left[M^{-1}L^3 - T^{-2}\right]$

C. $\left[M^{-1}L^2, T^{-2}\right]$

D. $\left[ML^{-3}T^{-2}\right]$

Answer:

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5. Two particle A and B (both initially at rest) start moving towards each other under 3 mutual force of attraction. At the instant when the speed of a is v and the speed of B is 2v, the speed of the centre of mass is

A. Zero

B. v

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

D. $-\frac{3v}{2}$

Answer:

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6. Three vectors $\vec{A} = a\vec{i} + \vec{j} + \vec{k} : \vec{B} = \vec{i} + b\vec{j} + \vec{k}$ and $\vec{C} = \vec{i} + \vec{j} + c\vec{k}$ are mutually perpendicular $\left(\vec{i} . \vec{j} \text{ and } \vec{k}\right.$ are unit vectorts along X.Y. and Z axis respectively). The respective values of a,b and c are

A. 0,0,0

B. $-\frac{1}{2}, -\frac{1}{2}, -\frac{1}{2}$

C. $1, -1, 1$

D. $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$

Answer:

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7. A block of mass 1 kg starts from rest at x=0 and moves along the x-axis under the action of a force F=kt, where t is time and $k = 1Ns^{-1}$. The distance the block will travel in 6 second is

A. 36 m

B. 72 m

C. 108 m

D. 18 m

Answer:

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8. The velocity of a particle executing a simple harmonic motion is $13ms^{-1}$ when its distance from the equilibrium position (Q) is 3 m and its velocity is $12ms^{-1}$, when it is 5 m away from Q. The frequency of the simple harmonic motion is

A. $\frac{5\pi}{8}$

B. $\frac{5}{8\pi}$

C. $\frac{8\pi}{5}$

D. $\frac{8}{5\pi}$

Answer:

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9. A uniform string of length L and mass M is fixed at both ends while it is subject to a tension T . It can vibrated of frequencies (v) given by the formula (where n = 1 , 2, 3.....)

A. $v = \frac{n}{2}\sqrt{\frac{T}{ML}}$

B. $v = \frac{n}{2L}\sqrt{\frac{T}{ML}}$

C. $v = \frac{1}{2n}\sqrt{\frac{T}{ML}}$

D. $v = \frac{n}{2}\sqrt{\frac{T}{ML}}$

Answer:

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10. A uniform capillary tube of length l and inner radius r with its upper end sealed is submerged vertically into water. The outside pressure is p, and surface tension of water is γ. When a length x

of the capillary is submerged into water, it is found that water levels inside and outside the capillary coincide, the value of x is

A. $\frac{l}{\left(l+\frac{p_o r}{4\gamma}\right)}$

B. $l\left(l-\frac{p_o r}{4\gamma}\right)$

C. $l\left(l-\frac{p_o r}{2\gamma}\right)$

D. $\frac{l}{\left(l+\frac{p_o r}{2\gamma}\right)}$

Answer:

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11. A liquid of bulk modulus k is compressed by applying an external pressure such that its density increases by $0.01\,\%$. The pressure applied on the liquid is

A. $\frac{k}{10000}$

B. $\frac{k}{1000}$

C. 1000 k

D. 0.01 k

Answer:

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12. Temperature of an ideal gas initially at $27^\circ C$ is raised by $6^\circ C$, The rms velocity of the gas molecule will

A. increases by nearly 2%

B. decrease by nearly 2%

C. increase by nearly 1%

D. decrease by nearly 1%

Answer:

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13. 2 mole of an ideal monatomic gas is carried from a state (P_o, V_0) to state $(2P_0, 2V_o)$ along a straight line path in a P-V diagram. The amount of heat absorbed by the gas in the process is given by

A. $4P_oV_o$

B. $\frac{9}{2}P_oV_o$

C. $6P_oV_o$

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

Answer:

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14. A solid rectangular sheet has two different coefficients of linear expansion α_1 and α_2 along its length and breadth respectively. The coefficient of surface expansion is $(\text{for } \alpha_1 t << 1, \alpha_2 t << 1)$

A. $\frac{\alpha_1 + \alpha_2}{2}$

B. $2(\alpha_1 + \alpha_2)$

C. $\frac{4\alpha_1\alpha_2}{\alpha_1 + \alpha_2}$

D. $\alpha_1 + \alpha_2$

Answer:

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15. A positive charge Q is situated at the centre of cube. The electric flux through any face of the cube is (in SI units)

A. $\frac{Q}{6\varepsilon_0}$

B. $4\pi Q$

C. $\frac{Q}{4\pi\varepsilon_v}$

D. $\frac{Q}{6\pi\varepsilon_0}$

Answer:

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16. Three capacitors of capacitance $1.0, 2.0 \text{ and } 5.0\mu F$ are connected in series to a 10 source. The potential difference across th $2.0\mu F$ capacitor is

A. $\frac{100}{17}V$

B. $\frac{20}{17}V$

C. $\frac{50}{17}V$

D. $10V$

Answer:

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17. A charge of 0.8 coulomb is divided into two charges Q_1 and Q_2. These are kept at a separation of 30 cm. The force on Q_1 is maximum when

A. $Q_1 = Q_2 = 0.4C$

B. $Q_1 = 0.8, C, Q_2$ negligible

C. Q_1 negligible, $Q_2, 0.8C$

D. $Q_1 = 0.2C. Q_2 = 0.6C$

Answer:

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18. In the magnetic field due to a current in a straight wire segement of length L at a point on its perpendicular bisector at a distance $r(r > > 1)$.

decreases as $\frac{1}{r}$

decreases as $\frac{1}{r^2}$

decreases as $\frac{1}{r^3}$

approches a finite limits as $r \to \infty$

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19. The magnets of two suspended coil galvanometers are of the same strength so that they produce identical magnetic fields in the region of the coils. The coil of the first one is in the shape of a square of side a and that of the second one is circular of radius $a/\sqrt{\pi}$. when the same current is passed through the coils, the

ratio of the torque experinced by the first coil to the experinced by the second one is

A. $1 : \frac{1}{\sqrt{\pi}}$

B. $1 : 1$

C. $\pi : 1$

D. $1 : \pi$

Answer:

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20. A proton is moving with a uniform velocity of $10^6 ms^{-1}$ along the Y-axis, under the joint action of a magentic field along Z-axis and an electric field of magnitude $2 \times 10^4 Vm^{-1}$ along the negative X-axis if the electric field as switched off. the proton

starsts movinv in a circle. The radius of the circle is nearly (given $\frac{e}{m}$ ratio for proton $= 10^8 Ckg^{-1}$)

A. $0.5m$

B. $0.2m$

C. $0.1m$

D. $0.05m$

Answer:

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21. When the frequency of the AC voltage applied to a series LCR circuit is gradually increases from a low value, the impedance of the circuit

A. monotonically increases

B. first increases and then decreases

C. first decreases and then increases

D. monotonically decreases

Answer:

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22. Six wires. Each of resistancde r. are connected so as to form a tetrahedron. The equivalent resistance of the combination when current enters through one corner and leaves through some corner is

A. r

B. 2r

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

D. $\frac{r}{2}$

Answer:

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23. The ratio of the diameter of the sun to the distance between the earth and the sum is approximately 0.009. The approximate diameter of the image of the sun formed by a concave spherical mirror of radius of curvature 0.4 m is

A. $4.5 \times 10^{-6} m$

B. $4.0 \times 10^{-6} m$

C. $3.6 \times 10^{-3} m$

D. $1.8 \times 10^{-3} m$

Answer:

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24. Two monochromatic eoherent light beams A and B have intensities L. and $\frac{L}{4}$ respectively. If these beams are superposed. The maximum and minimum intensities will be

A. $\frac{9I}{4}, \frac{L}{4}.$

B. $\frac{5I}{4}, 0$

C. $\frac{5I}{2}, 0$

D. $2L, \frac{L}{2}$

Answer:

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25. A point object is held above a thin equiconvex lens at its focus. The focal length is 0.1 m and the lens rests on a horizontal thin plane mirror. The final image will be formed at

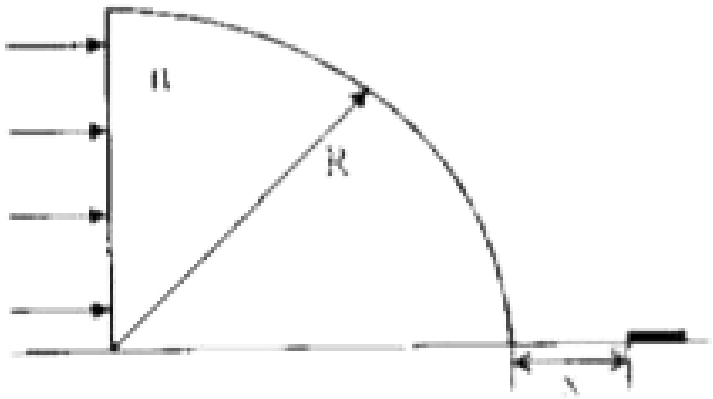
A. infinite distance above the lens

B. 0.1 m above the center of the lens

C. infinite distance below the lens

D. 0.1 m below the center of the lens.

Answer:



26.

A parallel beam of light is incident on a glass prism in the shape of a quarter cylinder of radius R=0.5 m and refractive index n 1.5 placed on a horizontal table as shown in the figure. Beyond the cylinder a patch of light is found whose nearest distance x from the cylinder is

A. $\left(3\sqrt{3}-4\right)\times 10^{-2}m$

B. $\left(3\sqrt{3}-2\right)\times 10^{-2}m$

C. $\left(3\sqrt{3}-5\right)\times 10^{-2}m$

D. $\left(3\sqrt{2}-3\right)\times 10^{-2}ms$

Answer:

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27. The de Broglie wavelenght of an electron is 0.4×10^{-10} m when it kinetic energy is $1.0kev$. Its wavelenght will be $1.0 \times 10^{-10}m$. When its kinetic energy is

A. $0.2KeV$

B. $0.8KeV$

C. $0.63KeV$

D. $0.16KeV$

Answer:

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28. A unit negative charge with mass M resides at the midpoint of the straight line of length 2a adjoining two fixed charges of magnitude $+Q$ each if it is given n very small displacement $x(x << a)$ in a direction perpendicular to the straight line. It will

A. come back to its original position and stay there

B. evecute oscillations with frequency $\frac{1}{2\pi}\sqrt{\frac{Q}{2\pi\varepsilon_0 Ma^3}}$

C. fly to infinity

D. execute oscillation with frequency $\frac{1}{2\pi}\sqrt{\frac{Q}{4\pi\varepsilon_0 Ma^2}}$

Answer:

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29. A particle with charge Q coulomb, tied at the end of an inextensible string a length R meter, revolves in a vertically plane. At the centre of the circular trajectory there is a fixed charge of magnitude Q coulomb. The mass of the moving charge M is such that $Mg = \frac{Q^2}{4\pi\varepsilon_0 R^2}$ if at the highest position of the partical the tnesion of the string just vanishes, the horizontal velocity at the lowest point base to the

A. 0

B. $2\sqrt{gR}$

C. $\sqrt{2gR}$

D. $\sqrt{5gR}$

Answer:

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30. A bullet of mas $4.2 \times 10^{-2} kg$ moving at a speed of $300 ms^{-1}$ gets into a block with a mass 9 times thatt of the bullet. If the block is free to move without any kind of friction, the heat generated in the process will be

A. 45 cal

B. 405 cal

C. 450 cal

D. 1701 cal

Answer:

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31. A particle with charge e and mass m. moving along the X-axis with a uniform speed u enters a region where a uniform electric

field F, is acting along The Y-axis. The particle starts to move in a parabola, its focal length (neglecting any effect of gravity) is

A. $\frac{2\mathrm{mu}^2}{eE}$

B. $\frac{eE}{2\mathrm{mu}^2}$

C. $\frac{\mathrm{mu}}{2eE}$

D. $\frac{\mathrm{mu}^2}{2eE}$

Answer:

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32. Let v_n and E_a be the respective speed and energy of an electron in the n^{th} orbit of radius r_n in a hydrogen atoms, as predieted by Bohr's model. Then

A. plot of $E_o r_o E_1 r_1$ as a fuction of n is a straight line of slope 0

B. plot of $r_n v_n r_1 v_1$ as a fuction of n is a straight line of slope 1.

C. plot of ln $\left(\frac{r_o}{r_1}\right)$ as a fucntion of ln (n) is a straight line of slope 2.

D. plot of ln $\left(r_n \frac{E_n}{E_n r_1}\right)$ as a fucntion of ln (n) is a straight line of slope 4.

Answer:

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33. A small steel ball bounces on a steel plate held horizontally. On each bounce the speed of the ball arriving at the plate is reduced by a factor e (coefficient of restitution) in the rebound, so that

$V_{\text{upward}} = eV_{\text{downward}}$

If the ball is initially dropped from a height of 0.4 m above the plate and if 10 seconds later the bouncing ceases. The value of e is

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

B. $\frac{3}{4}$

C. $\frac{13}{18}$

D. $\frac{17}{18}$

Answer:

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34. If the pressure, temperature and density of an ideal gas are denoted by P.T and ρ respectively. The velocity of sound in the gas is

A. proportional to $\sqrt{P}$ when T is constant

B. proportional to $\sqrt{T}$

C. proportional to $\sqrt{P}$. When ρ is constant

D. proportional to T.

Answer:

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35. Two long parallel wiress separated by 0.1 m carry currents of 1 A and 2 A respectively in opposite directions. A third current-carrying wire parallel to both of them is placed in the same plane such that it feels no net magnetic force it is placed at a distance of

A. 0.5 m from the 1^{st} wire, towards the 2^{nd} wire.

B. 0.2 m from the 1^{st} wire, towards the 2^{nd} wire.

C. 0.1 m from the 1^{st} wire, away from the 2^{nd} wire.

D. 0.2 m from the 1^{st} wire, away from the 2^{nd} wire.

Answer:

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36. If χ stands for the manetic susceptibility of a substance μ for its magnetic permeabuility and μ_0 for the permeability of free space. Then

A. for a paramagnetic substance : $\chi > 0. \mu > 0$

B. for a paramagnetic substance : $\chi > 0. \mu > \mu_0$

C. for a diamagnetic substance : $\chi < 0. \mu > 0$

D. for a ferromagnetic substance : $\chi > 1. \mu > \mu_0$

Answer:

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