

# PHYSICS

## BOOKS - NTA MOCK TESTS

### NTA JEE MOCK TEST 69

#### Physics

1. The  $K_{\alpha}$  line obtained for molybdenum ( $Z = 42$ ) is  $0.71 \text{ \AA}$ . Then, the wavelength of the  $K_{\alpha}$  line of copper ( $Z = 29$ ) is

A.  $21.4\text{\AA}$

B.  $1.52\text{\AA}$

C.  $1.04\text{\AA}$

D.  $0.71\text{\AA}$

**Answer: B**



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2. A flat mirror revolves at a constant angular velocity making  $n = 0.4$  revolutions per second. With what velocity (in  $\text{m s}^{-1}$ ) will a

light spot move along a spherical screen with a radius of 15 m, if the mirror is at the centre of curvature of the screen ?

A. 37.7

B. 60.3

C. 68.7

D. 75.4

**Answer: D**



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3. A copper wire of cross-sectional area  $3.00 \times 10^{-6} m^2$  carries a current  $10.0 A$ .

a. Find the drift speed of the electrons in the wire. Assume that each copper atom contributes one free electron to the body of material.

b. Find the average time between collisions for electrons in the copper at  $20^\circ C$ . The density of copper is  $8.95 gcm^{-3}$ , molar mass of copper is  $63.5 gmol^{-1}$ , Avogadro number is  $6.02 \times 10^{23}$  electrons per mol and resistivity of copper is  $1.7 \times 10^{-8} \Omega m$ .

A.  $0.24 \text{ m s}^{-1}$

B.  $0.12 \text{ m s}^{-1}$

C.  $2.4 \text{ m s}^{-1}$

D.  $0.06 \text{ m s}^{-1}$

**Answer: B**



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4. A neutral sphere of radius  $r$  and density  $\rho$  is placed in a uniform electric field  $E$  that exists on the earth's surface in the vertically upward

direction. If atomic number and the mass number of the material of the sphere are  $Z$  and  $A$  respectively, then the fraction of electrons that should be removed from the sphere for it to remain in equilibrium is [Assume that the sphere is able to hold the necessary charge without any leakage. Here  $N_A$  - Avogadro number]

A.  $\frac{2g}{eEZAN_A}$

B.  $\frac{3gA}{eEN}$

C.  $\frac{gA}{eEZAN_A}$

D.  $\frac{2g \cdot A}{eEZN_A}$

**Answer: C**



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5. Two identical satellites are moving around the Earth in circular orbits at heights  $3R$  and  $R$  respectively where  $R$  is the radius of the Earth. The ratio of their kinetic energies is  $x$ . Find  $x$ .

A. 2:1

B. 1 : 2

C. 3 : 1

D. 2 : 3

**Answer: B**



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**6.** An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas ?



A. Isobaric

B. Isochoric

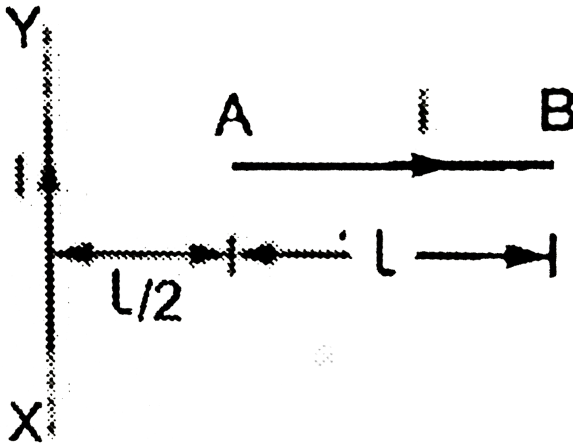
C. Isothermal

D. Adiabatic

**Answer: D**



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7.

A conductor  $AB$  of length  $l$  carrying a current  $i$  is placed perpendicular to a long straight conductor  $XY$  carrying a current  $I$ , as shown.

The force on  $AB$  will act

A.  $\frac{\mu_0 I i}{2\pi} \ln 2$

B.  $\frac{\mu_0 I i}{2\pi} \ln 3$

C.  $\frac{3\mu_0 I i}{2\pi}$

D.  $\frac{2\mu_0 I i}{3\pi}$

**Answer: B**



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**8.** A ball is projected from the ground at angle  $\theta$  with the horizontal. After  $1s$ , it is moving at angle  $45^\circ$  with the horizontal and after  $2s$  it is moving horizontally. What is the velocity of projection of the ball ?

A.  $10\sqrt{3}ms^{-1}$

B.  $20\sqrt{3}ms^{-1}$

C.  $10\sqrt{5}ms^{-1}$

D.  $20\sqrt{2}ms^{-1}$

**Answer: C**



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9. A 2000 kg rocket in free space expels 0.5 kg of gas per second at exhaust velocity

$400 \text{ m s}^{-1}$  for 5 s. The increase in the speed of the rocket in this time is

A.  $2000 \text{ m s}^{-1}$

B.  $200 \text{ m s}^{-1}$

C.  $0.5 \text{ m s}^{-1}$

D. zero

**Answer: C**



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10.  $M_p$  depends the mass of a proton and  $M_n$  that of a neutron. A given nucleus, of binding energy  $B$ , contains  $Z$  protons and  $N$  neutrons. The mass  $M(N,Z)$  of the nucleus is given by ( $c$  is the velocity of light)

A.  $M(N, Z) = NM_n + ZM_p - Bc^2$

B.  $M(N, Z) = NM_n + ZM_p + Bc^2$

C.  $M(N, Z) = NM_n + ZM_p - B/c^2$

D.  $M(N, Z) = NM_n + ZM_p + B/c^2$

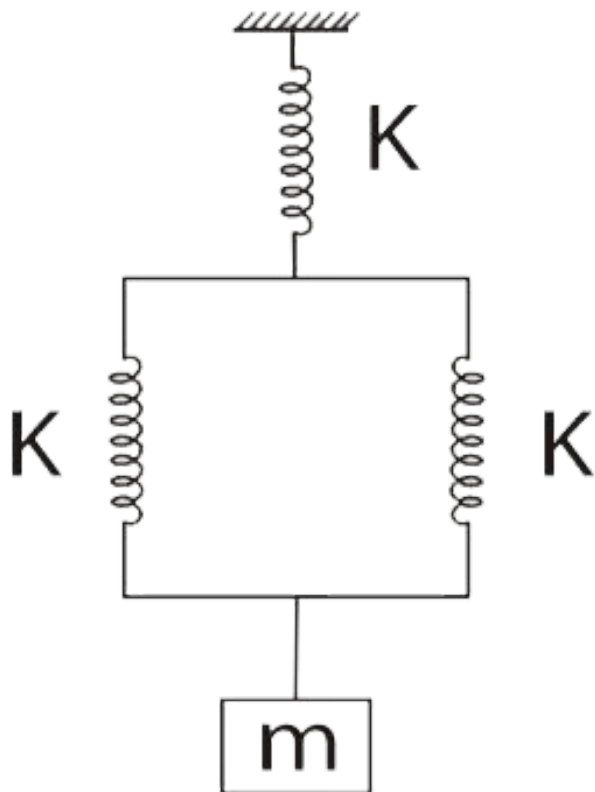
**Answer: C**



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**11.** A body of mass ' $m$ ' hangs from three springs, each of spring constant ' $k$ ' as shown in the figure. If the mass is slightly displaced and let go, the system will oscillate with time

period-



A.  $2\pi \sqrt{\frac{m}{3k}}$

B.  $2\pi \sqrt{\frac{3m}{2k}}$

C.  $2\pi \sqrt{\frac{2m}{3k}}$



D.  $2\pi\sqrt{\frac{3k}{m}}$

**Answer: B**



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**12.** For certain metal incident frequency  $\nu$  is five times threshold frequency  $\nu_0$  and the maximum velocity of the photoelectrons is  $8 \times 10^6 \text{ m s}^{-1}$ . If incident photon frequency is  $2\nu_0$ , the maximum velocity of photoelectrons will be

A.  $4 \times 10^6 \text{ms}^{-1}$

B.  $6 \times 10^6 \text{ms}^{-1}$

C.  $8 \times 10^6 \text{ms}^{-1}$

D.  $1 \times 10^6 \text{ms}^{-1}$

**Answer: A**



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**13.** The radius  $R$  of the soap bubble is doubled under isothermal condition. If  $T$  be the surface

tension of soap bubble. The work done in doing so is given by

A.  $32\pi R^2 T$

B.  $24\pi R^2 T$

C.  $8\pi R^2 T$

D.  $4\pi R^2 T$

**Answer: B**



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14. From a disc of radius  $R$ , a concentric circular portion of radius  $r$  is cut out so as to leave an annular disc of mass  $M$ . The moment of inertia of this annular disc about the axis perpendicular to its plane and passing through its centre of gravity is

A.  $\frac{1}{2}M(R^2 + r^2)$

B.  $\frac{1}{2}M(R^2 - r^2)$

C.  $\frac{1}{2}M(R^4 + r^4)$

D.  $\frac{1}{2}M'(R^4 - r^4)$

**Answer: A**



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**15. A transistor oscillator is**

(i) An amplifier with positive feedback

(ii) An amplifier with reduced gain

(iii) The one in which DC supply energy is converted into AC output energy. Then

A. All (i), (ii) and (iii) are correct

B. (i) and (ii) are correct

C. (i) and (iii) are correct

D. (ii) and (iii) are correct

**Answer: C**



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**16.** A cylinder closed at both ends is separated into two equal parts (45 cm each) by a piston impermeable to heat. Both the parts contain the same masses of gas at a temperature of 300 K and a pressure of 1 atm. If now the gas

in one of parts is heated such that the piston shifts by 5 cm, then the temperature and the pressure of the gas in this part after heating is

A.  $T = 365 \text{ K}$  and  $P = 1.125 \text{ atm}$

B.  $T = 350 \text{ K}$  and  $P = 1.125 \text{ atm}$

C.  $T = 375 \text{ K}$  and  $P = 2.125 \text{ atm}$

D.  $T = 375 \text{ K}$  and  $P = 1.125 \text{ atm}$

**Answer: D**



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17. The dimensional formula for areal velocity is

A.  $[M^0 L^{-2} T]$

B.  $[M^0 L^{-2} T^{-1}]$

C.  $[M^0 L^2 T^{-1}]$

D.  $[M^0 L^2 T]$

**Answer: C**



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18. The instantaneous displacement of a simple pendulum oscillator is given by  $x = A \cos\left(\omega t + \frac{\pi}{4}\right)$  Its speed will be maximum at time

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

B.  $\frac{\omega}{2\pi}$

C.  $\frac{\omega}{\pi}$

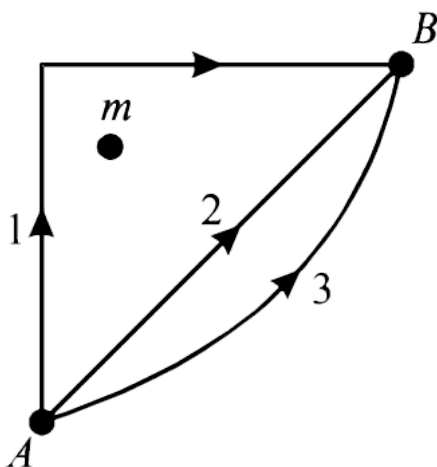
D.  $\frac{\pi}{4\omega}$

**Answer: D**



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19. If  $W_1$ ,  $W_2$  and  $W_3$  represent the work done in moving a particle from  $A$  to  $B$  along three different paths 1, 2 and 3 respectively (as shown) in the gravitational field of a point mass  $m$ , find the correct relation between  $W_1$ ,  $W_2$  and  $W_3$ .



A.  $W_1 > W_2 > W_3$

B.  $W_1 = W_2 = W_3$

C.  $W_1 < W_2 < W_3$

D.  $W_2 > W_1 > W_3$

**Answer: B**



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**20.** A machine gun has a mass 5 kg. It fires 50 gram bullets at the rate of 30 bullets per

minute at a speed of  $400 \text{ m s}^{-1}$ . What force is required to keep the gun in position ?



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21. An A.C. voltage  $V = 5 \cos(1000t) \text{ V}$  is applied to an  $L - R$  series circuit of inductance  $3 \text{ mH}$  and resistance  $4 \Omega$ . The value of the maximum current in the circuit is ..... A.



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**22.** A particle moves according to the law  $x = r \cos\left(\frac{\pi t}{2}\right)$ . The distance covered by it in the time interval between  $t = 0$  and  $t = 3$  s in nr. What is the value of n?



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**23.** A uniform copper rod 50 cm long is insulated on the sides, and has its ends exposed to ice and steam, respectively. If there is a layer of water 1 mm thick at each end, calculate the temperature gradient in the bar.

The thermal conductivity of copper is  $436Wm^{-1}K^{-1}$  and that of water is  $0.436Wm^{-1}K^{-1}$ .



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**24.** If the distance between the virtual image from its real object is 60 cm in case of a concave mirror. The focal length of the concave mirror If the image formed is 3 times magnified image is



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