



# Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Ltd.)

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MM : 120

## Sample Paper : Campus Recruitment Test Physics (Engineering)

Time : 1½ Hr.

### Complete Syllabus of Class XI & XII

#### Instructions:

- Use ball point pen only to darken the appropriate circle.
- Mark should be dark and should completely fill the circle.
- Dark only one circle for each entry.
- Dark the circle in the space provided only.
- Rough work must not be done on the Answer sheet and do not use **white-fluid** or any other **rubbing material** on Answer sheet.
- Each question carries 3 marks. For every wrong response 1 mark shall be deducted from the total score.

#### Choose the correct answer :

- An arrow is shot into air. Its range is 200 m and its time of flight is 5 second. If  $g = 10 \text{ m/s}^2$ , then the horizontal component of velocity of the arrow is
  - 12.5 m/s
  - 25 m/s
  - 31.25 m/s
  - 40 m/s
- A stone weights  $(10.0 \pm 0.1) \text{ kg}$  in air. The weight of the stone in water =  $(5.0 \pm 0.1) \text{ kg}$ . The maximum % error in the measurement of the specific gravity is
  - 5%
  - 6%
  - $\left(\frac{4}{3}\right)\%$
  - 2%
- Three masses are placed on the  $y$ -axis; 200 gm at  $y = 0 \text{ cm}$ , 500 gm at  $y = 30 \text{ cm}$  and 400 gm at  $y = 70 \text{ cm}$ . The distance of the centre of mass from origin is nearly
  - 0.4 m
  - 0.5 m
  - 0.6 m
  - 0.7 m
- The escape velocity of a body at a height  $h$  above the surface of the earth is 36% of that from the surface of earth. If  $v_0$  be the orbital velocity of this body near the surface of the earth, then what will be its orbital velocity at a height  $h$ ?
  - 36% of  $v_0$
  - $v_0$
  - 36% of  $v_e$
  - 18% of  $v_0$
- A body begins to slide over the surface of another body when pulled with a force of 7 N. If we pull it with a force of 5 N, then the force of friction that will come into play should be
  - Zero
  - 0.5 N
  - 5 N
  - Data insufficient
- The lower end of a capillary tube of radius  $r$  is placed vertically in water. If  $h$  be the rise of water in capillary, then the heat evolved is
  - $\frac{\pi r^2 h^2 g}{2}$
  - $\pi^2 r^2 h^2 g$
  - $\frac{\pi r^2 h^2 g}{3}$
  - $\frac{\pi r^2 h^2 g}{4}$

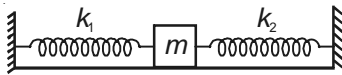
7. The gas in a vessel is subjected to a pressure of 20 atm at a temperature of 27°C. What is the pressure of the gas in the vessel after one half the mass of the gas is released from the vessel and the temperature of the remainder is raised by 50°C?

- (1) 11.7 atm                      (2) 17 atm  
(3) 8.5 atm                        (4) 10.8 atm

8. A bimetallic strip is heated through  $t^\circ\text{C}$ . If  $\alpha_1$  and  $\alpha_2$  be the linear co-efficients of expansion for the two metals, then the strip bends into an arc of radius  $R$  corresponding to inner strip. The thickness of each strip is  $d$ . The value of  $R$  is nearly

- (1)  $\frac{dt}{\alpha_2 - \alpha_1}$                       (2)  $(\alpha_2 - \alpha_1)dt$   
(3)  $\frac{d}{(\alpha_2 - \alpha_1)t}$                 (4)  $\frac{(\alpha_2 - \alpha_1) \cdot t}{d}$

9. A spring of constant  $k$  is cut into two parts having the ratio of their length 3:4 and now these parts having spring constants  $k_1$  and  $k_2$  are connected across a block of mass  $m$ . The time period of SHM of block will be



- (1)  $2\pi\sqrt{\frac{12m}{49k}}$                       (2)  $2\pi\sqrt{\frac{7m}{12k}}$   
(3)  $2\pi\sqrt{\frac{49m}{12k}}$                       (4)  $2\pi\sqrt{\frac{33m}{49k}}$

10. In Young's double slit experiment, the distance between 2 sources is 0.1 mm. The distance of the screen from source is 20 cm. Wavelength used is 5460 Å. The angular position of the first dark fringe is nearly

- (1) 0.08°                              (2) 0.16°  
(3) 0.20°                              (4) 0.32°

11.  $\frac{7}{8}$  part of an artificial radioactive element decays in 168 second. The half-life of the element is

- (1) 2 second                          (2) 108 second  
(3) 56 second                        (4) 256 second

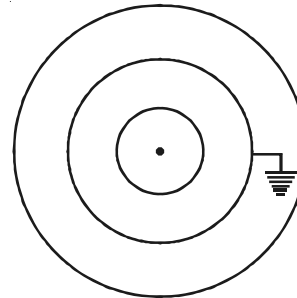
12. For a certain metal,  $\nu$  (frequency of incident radiation) is twice  $\nu_0$  (threshold frequency) and electrons come out with a maximum velocity of  $4 \times 10^8$  cm/sec. If the value of  $\nu$  is  $5\nu_0$ , then the maximum velocity of photo electron will be

- (1)  $2 \times 10^8$  cm/s                  (2)  $8 \times 10^8$  cm/s  
(3)  $20 \times 10^8$  cm/s                (4)  $\frac{4}{5} \times 10^8$  cm/s

13. The angle of minimum deviation for a prism of refractive index 1.5 is equal to the angle of prism. The angle of the prism is  $\alpha$ .  $\alpha$  is (given that  $\cos 41^\circ = 0.75$ )

- (1) 21°                                  (2) 42°  
(3) 60°                                  (4) 82°

14. There is a system of three concentric conducting shells having radii  $R$ ;  $2R$  and  $3R$  respectively. The innermost and outermost shells are given the charges  $Q$  and  $-4Q$  respectively and middle one is grounded. The charge on the outer surface of middle shell will be

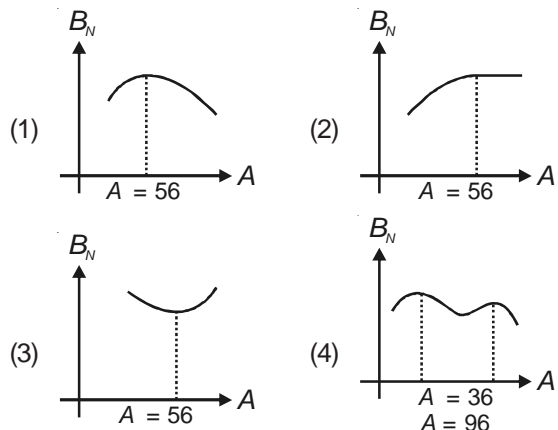


- (1)  $\frac{2Q}{3}$                                   (2)  $\frac{4Q}{3}$   
(3)  $\frac{6Q}{3}$                                   (4)  $\frac{8Q}{3}$

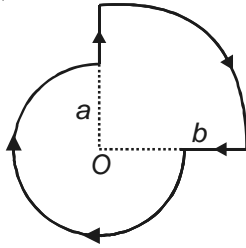
15. A resistor and an inductor are connected in series to a 220 V A.C. supply. When measured with A.C. voltmeter, the potential difference across the resistor is 132 volt, the potential difference across the terminals of the inductor is

- (1) 80 volt  
(2)  $\sqrt{220 \times 132}$  volt  
(3) 176 volt  
(4) 358 volt

16. The dependence of binding energy per nucleon,  $B_N$  on the mass number  $A$  is approximately represented by

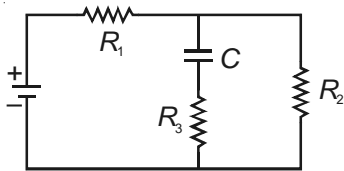


17. The magnetic field at the centre  $O$  is

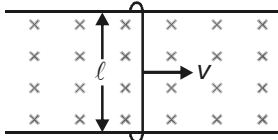


- (1)  $\left(\frac{\mu_0 I}{2a} + \frac{\mu_0 I}{2b}\right) \otimes$       (2)  $\left(\frac{3\mu_0 I}{8a} + \frac{\mu_0 I}{8b}\right) \otimes$   
 (3)  $\left(\frac{3\mu_0 I}{8a} - \frac{\mu_0 I}{8b}\right) \otimes$       (4)  $\left(\frac{3\mu_0 I}{8a} + \frac{\mu_0 I}{4b}\right) \otimes$

18. In the circuit shown in figure the steady state voltage across capacitor  $C$  is a fraction  $f$  of the battery emf. The fraction is decided by

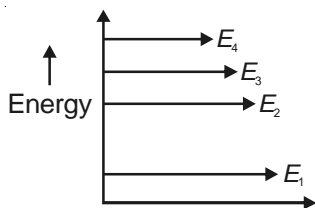


- (1)  $R_1$  only      (2)  $R_1$  &  $R_3$  only  
 (3)  $R_1$  &  $R_2$  only      (4)  $R_1, R_2$  &  $R_3$
19. The figure shows a wire sliding on two parallel conducting rails placed at a separation  $\ell$ . A magnetic field  $B$  exists in a direction perpendicular to plane of the rails. The force required to keep the wire moving at a constant velocity  $v$  is



- (1)  $\ell^2 B$       (2)  $\frac{\mu_0 B}{4\pi}$   
 (3)  $\frac{B\ell^2}{\mu_0 4\pi}$       (4) Zero

20. Figure represents, drawn to scale, the energy levels for an electron in a certain atom. The transition from  $E_3$  to  $E_1$  produces a green line. What transition could give rise to a red line?



- (1)  $E_2$  to  $E_1$       (2)  $E_4$  to  $E_1$   
 (3)  $E_3$  to  $E_1$       (4) All of these

21. Induced electric field lines

- (1) Always make closed path  
 (2) Do not make closed path  
 (3) May make closed path  
 (4) Are always straight

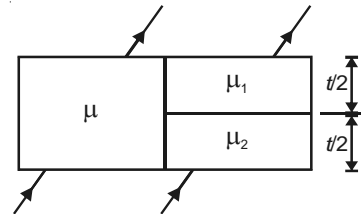
22. An electron is revolving round the nucleus in a circular orbit of radius  $R$  with speed  $V$ . The magnetic dipole moment of system is

- (1)  $\frac{eVR}{2}$       (2)  $\frac{\mu_0 eV}{4\pi R^3}$   
 (3) Zero      (4)  $eVR$

23. Half life of polonium is 138 days. The last nucleus of this radioactive sample will decay in

- (1) 138 days      (2)  $2 \times 138$  days  
 (3)  $4 \times 138$  days      (4) Unpredictable

24. In the following figure, a parallel beam emerges parallel. The relation between  $\mu$ ,  $\mu_1$  and  $\mu_2$  is



- (1)  $\mu = \mu_1 + \mu_2$       (2)  $\frac{1}{\mu} = \frac{1}{\mu_1} + \frac{1}{\mu_2}$   
 (3)  $\mu = \frac{\mu_1 + \mu_2}{2}$       (4)  $\frac{2}{\mu} = \frac{1}{\mu_1} + \frac{1}{\mu_2}$

25. In YDSE, the angular position of point closest to central maxima intensity is  $\frac{1}{4}$ th of the maxima intensity is

- (1)  $\sin^{-1}\left(\frac{\lambda}{d}\right)$       (2)  $\sin^{-1}\left(\frac{\lambda}{2d}\right)$   
 (3)  $\sin^{-1}\left(\frac{\lambda}{3d}\right)$       (4)  $\sin^{-1}\left(\frac{\lambda}{4d}\right)$

26. Anode voltage is at +3 V. Incident radiation has frequency  $1.4 \times 10^{15}$  Hz and work function of the photo cathode is 2.8 eV. The minimum and maximum KE of photo electrons reaching the surface of anode is nearly

- (1) 3, 6 (in eV)      (2) 0, 3 (in eV)  
 (3) 0, 6 (in eV)      (4) 2.8, 5.8 (in eV)

27. A charge  $q$  is uniformly distributed with in the volume of hollow sphere (insulated) of inner and outer radii  $r_1$  and  $r_2$  ( $r_2 > r_1$ ). The electric field at a point  $P$  at a distance  $x$  from the centre is ( $r_1 < x < r_2$ )

(1)  $\frac{qx}{4\pi\epsilon_0(r_2^3 - r_1^3)}$  (2)  $\frac{q(x^3 - r_1^3)}{4\pi\epsilon_0(r_2^3 - r_1^3)}$

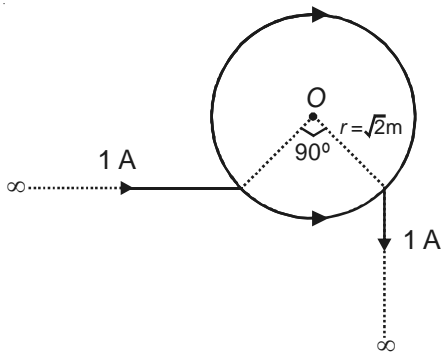
(3)  $\frac{q(x^3 - r_1^3)}{4\pi\epsilon_0 x^2(r_2^3 - r_1^3)}$  (4)  $\frac{qr_1^3}{4\pi\epsilon_0 x^2(r_2^3 - r_1^3)}$

28. A thin disc (or dielectric) having radius "a" and charge  $q$  distributed uniformly over the disc is rotated with "n" rotations per second about its axis. The magnetic field at the centre of disc is

(1)  $\frac{\mu_0 qn}{a}$  (2)  $\frac{\mu_0 qn}{2a}$

(3)  $\frac{\mu_0 qn}{4a}$  (4)  $\frac{3\mu_0 qn}{4a}$

29. In the figure shown, what will be the magnitude of magnetic field at the centre "O" of coil. Both the straight sections are infinitely long and wire is of uniform cross-section?



(1)  $\frac{\mu_0}{2\pi} \left( 2 + \frac{\pi}{\sqrt{2}} \right)$  (2)  $\frac{\mu_0}{2\pi} \left( 1 + \frac{\sqrt{3}\pi}{2} \right)$

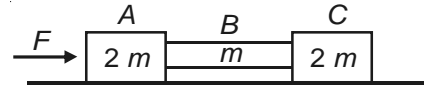
(3)  $\frac{\mu_0}{2\pi} \left( 3 + \frac{\pi}{\sqrt{2}} \right)$  (4) Zero

30. There are four objects ring, disc, hollow sphere and solid sphere of same mass and same radii and they are released from top of rough inclined surface from same position having same  $\mu$  but friction is insufficient for their pure rolling (for all). Which object will have more rotational kinetic energy at bottom?

(1) Ring (2) Hollow sphere

(3) Solid sphere (4) Same for all

31. The system is pushed by a force  $F$  as shown. All surfaces are smooth except between  $B$  and  $C$ . Friction co-efficient between  $B$  and  $C$  is  $\mu$ . Minimum value of  $F$  to prevent block  $B$  from slipping is



(1)  $\frac{3mg}{2\mu}$  (2)  $\frac{5mg}{2\mu}$

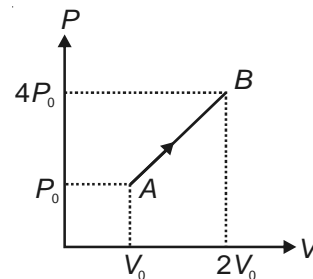
(3)  $\frac{5}{2}\mu mg$  (4)  $\frac{3}{2}\mu mg$

32. The force  $F = Cy^2(\hat{j})$  with  $C$  as negative constant, is

(1) Conservative (2) Non-conservative

(3) Restoring (4) Dissipative

33. One mole of a diatomic gas is undergoing the process shown by  $P$ - $V$  diagram. Molar specific heat of the gas for this process will be ( $R$ : gas constant)



(1)  $\frac{13R}{4}$

(2)  $3R$

(3)  $\frac{20R}{7}$

(4)  $\frac{25R}{7}$

34. There are 12 identical balls kept at equal separation between them. All the odd number balls move towards right and even number balls towards left with same speed. If all the collisions (head-on) are elastic in nature then the total number of possible collisions will be

(1) 10

(2) 15

(3) 21

(4) 24

35. A body of mass  $M$  is having potential energy  $U(x) = U_0(1 - \cos dx)$ , where  $U_0$  and  $d$  are constant. The time period of small oscillations is

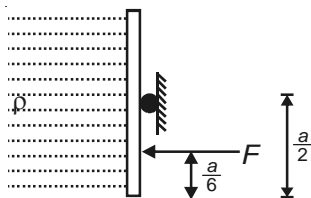
(1)  $2\pi\sqrt{MU_0d^3}$

(2)  $2\pi\sqrt{\frac{M}{U_0d^2}}$

(3)  $2\pi\sqrt{\frac{U_0d^2}{M}}$

(4)  $2\pi\sqrt{\frac{U_0}{Md^2}}$

36. A liquid having density  $\rho$  is filled over one side of a square shaped gate, having dimension " $a \times a$ " and it is hinged exactly in the middle. Now an external force " $F$ " is applied at a height  $\frac{a}{6}$  from the bottom to keep it in equilibrium. The magnitude of " $F$ " should be



- (1)  $\frac{\rho g a^3}{2}$                       (2)  $\frac{\rho g a^3}{4}$   
 (3)  $\frac{\rho g a^3}{6}$                       (4)  $\frac{\rho g a^3}{8}$
37. Two tuning forks when sounded together produce 6 beats per second. The first fork has the frequency 3% higher than a certain fixed frequency  $f_0$  and the second has the frequency 2% less than the  $f_0$ . The frequencies of the forks are
- (1) 126.3, 120.3 Hz  
 (2) 162.7, 156.7 Hz  
 (3) 136.2, 130.2 Hz  
 (4) 123.6, 117.6 Hz

38. An Indian pitcher has 10 kg of water. Water cools by means of evaporation through pores. Find the time in which the temperature of water falls by  $5^\circ\text{C}$  is nearly (Rate of evaporation is 5 g/min)

$[C_{\text{water}} = 1 \text{ cal/g}^\circ\text{C}, L_{\text{water}} = 540 \text{ cal/g}]$

- (1) 20 min, 10 second  
 (2) 18 min, 30 second  
 (3) 14 min, 12 second  
 (4) 10 min, 10 second
39. 3 moles of  $\text{H}_2$  are mixed with 1 mole of Ne. The specific heat at constant pressure is

- (1)  $\frac{9}{4}R$                       (2)  $\frac{13}{4}R$   
 (3)  $\frac{9}{2}R$                       (4)  $\frac{13}{2}R$

40. Anisotropic solid has linear expansion co-efficient as  $\alpha_x, \alpha_y, \alpha_z$  for three regular axis. The co-efficient of cubical expansion is

- (1)  $\alpha_x \alpha_y \alpha_z$                       (2)  $\frac{\alpha_x + \alpha_y + \alpha_z}{3}$   
 (3)  $\alpha_x + \alpha_y + \alpha_z$                       (4)  $\frac{\alpha_x \alpha_y}{\alpha_z}$





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- |         |         |         |         |
|---------|---------|---------|---------|
| 1. (4)  | 11. (3) | 21. (1) | 31. (2) |
| 2. (1)  | 12. (2) | 22. (1) | 32. (1) |
| 3. (1)  | 13. (4) | 23. (4) | 33. (3) |
| 4. (1)  | 14. (4) | 24. (4) | 34. (3) |
| 5. (4)  | 15. (3) | 25. (3) | 35. (2) |
| 6. (1)  | 16. (1) | 26. (1) | 36. (2) |
| 7. (1)  | 17. (2) | 27. (3) | 37. (4) |
| 8. (3)  | 18. (3) | 28. (1) | 38. (2) |
| 9. (1)  | 19. (4) | 29. (4) | 39. (2) |
| 10. (2) | 20. (1) | 30. (3) | 40. (3) |