

# PHYSICS

## IITian Test Series - Sample Paper

(2006 Batch)

- If a proton and an electron have same de-Broglie wavelength, then :
  - both have same kinetic energies
  - proton has more kinetic energy than electron
  - electron has more kinetic energy than proton
  - both have same velocity.
- Six  $\alpha$ -decays and a number of  $\beta$ -decays occur before  ${}_{90}\text{Pb}^{232}$  achieves stability; the final product in the chain being  ${}_{82}\text{Pb}^{208}$ . The number of  $\beta$ -disintegrations taking place is :
  - 2
  - 4
  - 6
  - 8.
- A chair is suspended from a spring with spring constant of 600 N/m. The periodic time for oscillation of this system is 1 s. When a man sits in this chair, the periodic time becomes 2.5s. The weight of the man is closest to a value of :
  - 650 N
  - 800N
  - 950 N
  - 110 N.
- A rain drop of radius 1.5 mm, experiences a drag force,  $F = (2 \times 10^{-5} v) \text{N}$ , while falling through air from a height of 2 km with a velocity  $v$ . The terminal velocity of the rain drop will be nearly :
  - 200 m/s
  - 80 m/s
  - 7 m/s
  - 3 m/s.

5. Match List I with List II and select the correct answer :

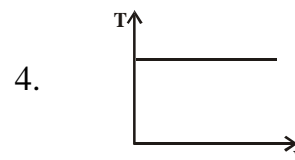
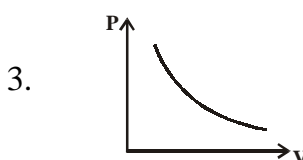
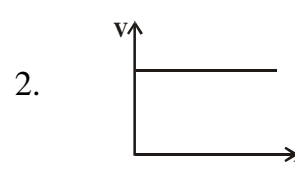
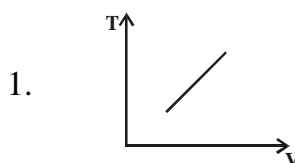
**List I**
**List II**

A. Isothermal process

B. Adiabatic process

C. Isochoric process

D. Isobaric process



	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	4	3	1	2
(d)	2	3	4	1

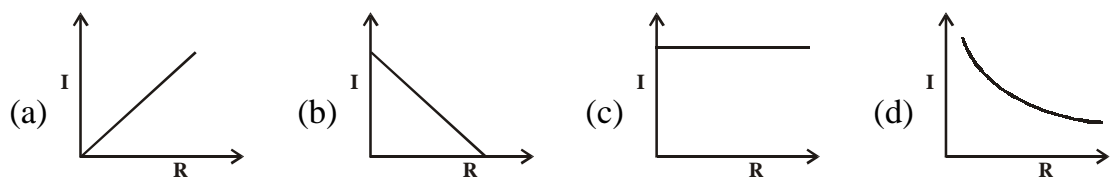
6. There is a point charge  $+q$  inside a hollow sphere and also a point charge  $-q$  just outside its surface. The total flux passing through the sphere is equal to :

- (a)  $-\frac{q}{\epsilon_0}$                       (b) 0                      (c)  $\frac{q}{\epsilon_0}$                       (d)  $\frac{2q}{\epsilon_0}$ .

7. Two condensers of capacitances  $2 \mu\text{F}$  and  $3 \mu\text{F}$  are charged to potential  $100 \text{ V}$  and  $200 \text{ V}$  respectively. They are then joined in parallel in such a way that plates which had positive charges are connected together. The energy dissipated into heat in the process is :

- (a)  $4 \text{ mJ}$                       (b)  $10 \text{ mJ}$                       (c)  $6 \text{ mJ}$                       (d)  $70 \text{ mJ}$ .

8. If a variable resistance is connected to a cell of constant e.m.f., then which one of the following graphs represents the relationship between current  $I$  and resistance  $R$  ?



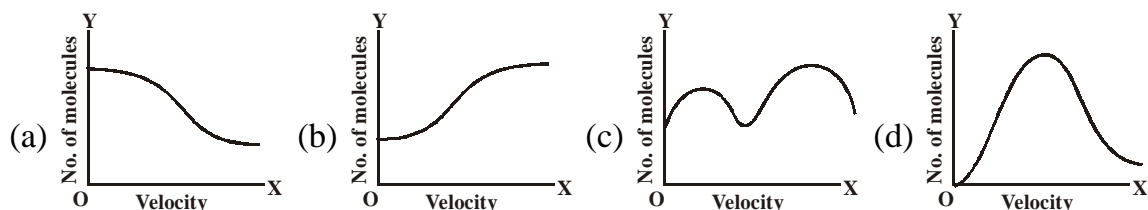
9. A man travelling in a car with a maximum constant speed of  $20 \text{ m/s}$  watches his friend start off at a distance of  $100 \text{ m}$  on a motor cycle with constant acceleration ' $a$ '. The man in the car will reach his friend when ' $a$ ' is :

1.  $< 2 \text{ m/s}^2$
2.  $> 2 \text{ m/s}^2$
3.  $= 2 \text{ m/s}^2$
4.  $= 4 \text{ m/s}^2$ .

Which of the above option(s) is/are correct ?

- (a) 1 and 3                      (b) 2 and 4                      (c) 1, 2 and 4                      (d) 1, 3 and 4.

10. Which one of the following curves represents Maxwell's distribution law of velocities of molecules in a gas ?



11. Consider the following nuclear reactions :

1.  ${}^2_1\text{H} + {}^1_1\text{H} \rightarrow {}^3_2\text{He} + \gamma$
2.  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^1_0\text{n} + {}^3_2\text{He}$
3.  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He} + \pi^0$ .

Which of the above reactions have been correctly represented ?

- (a) 1 and 2                      (b) 1 and 3                      (c) 2 and 3                      (d) 1, 2 and 3.

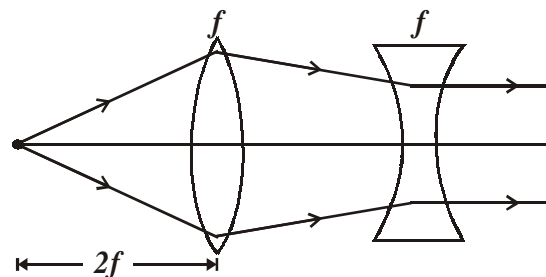
12. The angular frequency of motion whose equation is

$$4 \frac{d^2y}{dt^2} + 9y = 0$$

is ( $y$  is displacement and  $t =$  time) :

- (a)  $9/4$                       (b)  $4/9$                       (c)  $3/2$                       (d)  $2/3$ .
13. A coil of  $N$  turns, made of copper wire of length 4 m is placed in a magnetic field that changes with time. The value of  $N$ , for which induced e.m.f. will be maximum, is :
- (a) 1                      (b) 2                      (c) 3                      (d) 4.

14. A convex lens and a concave lens of focal length  $f$  each are kept at some separation shown in the figure. An object is kept at distance  $2f$  from the convex lens and rays from object after refracting from concave lens becomes parallel. If positions of lenses are interchanged then the final image formed will be :



- (a) virtual and smaller than the object    (b) real and smaller than the object  
(c) virtual and larger than the object    (d) real and larger than the object.
15. 1 cm high object is kept at distance 170 cm from the screen. A convex lens kept between them forms 16 cm high image on the screen. When convex lens is shifted by  $x$  along its principal axis then it again forms image on the same screen. The value of  $x$  is :
- (a) 10 cm                      (b) 150 cm                      (c) 160 cm                      (d) 30 cm.

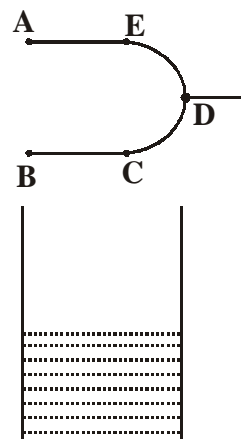
**Directions for question 16 to 20.**

The following questions consists of two statements, one labelled as ‘Assertion A’ and the other labelled as ‘Reason R’. You are to examine these two statements carefully and select the answer to these questions using the codes given below :

- (a) Both A and R are true and R is the correct explanation of A.  
(b) Both A and R are true but R is not the correct explanation of A.  
(c) A is true but R is false.                      (d) A is false but R is true.
16. A: Friction force is a dissipative force if there is sliding between bodies.  
R: Friction force is always directly proportional to normal reaction.
17. A: Concave lens is not used as magnifier glass.  
R: Concave lens forms virtual image for real object.
18. A: When solid converts into liquid its temperature remains constant.  
R: When solid converts into liquid, only molecular potential energy increases.
19. A: An observer observes always different frequency from frequency produced by source, if there is relative velocity between them.  
R: Frequency observed is always same as of frequency produced by source if both move with same velocity.
20. A: Bernoullie’s theorem is based on principle of conservation of energy.  
R: Continuity law is based on the principle of conservation of linear momentum.

**Directions for questions 21 to 25.**

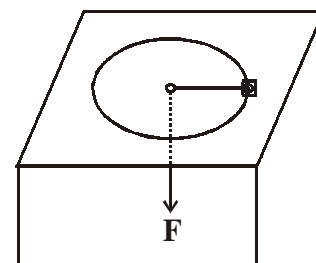
A tuning fork shown in the figure is used to resonate the resonance tube.



21. Which of the following statement is correct :
- Waves produced in the tube are of transverse nature.
  - Waves produced in the tube are of longitudinal nature.
  - Waves produced in the tube may be either of transverse nature or longitudinal nature.
  - Waves produced in the tube are of electromagnetic nature.
22. Which of the following statements is correct :
- In the tuning fork stationary wave is generated while in the tube travelling wave is generated.
  - In the tube stationary wave is generated while in the tuning fork travelling wave is generated.
  - In both tube and tuning fork the stationary waves are generated.
  - In both tube and tuning fork travelling waves are generated.
23. Phase difference at which both arms of tuning fork vibrates :
- zero
  - $\pi/2$
  - $\pi$
  - $2\pi$ .
24. Node will be formed at :
- A and B only
  - D only
  - C, E and D only
  - C and E only.
25. If natural frequency of tuning fork is 100 Hz then at resonance the frequency of tube :
- may be 100 Hz, 300 Hz, 500 Hz, .....
  - may be 100 Hz, 200 Hz, 300 Hz, .....
  - will be 300 Hz
  - will be 100 Hz.

**Directions for questions 26 to 30.**

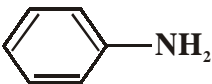
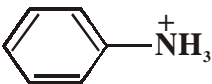
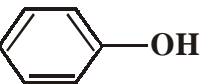
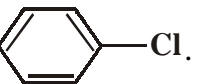
A block of mass  $m$  connected with light string is moving on circular path with angular velocity  $\omega$  on a smooth horizontal table. The free end of string passes through a hole in the table and is held by downward force  $F$  as shown in the figure.



26. The length of string above table is :
- $\frac{2F}{m\omega^2}$
  - $\frac{F}{2m\omega^2}$
  - $\frac{F}{m\omega^2}$
  - $\sqrt{\frac{F}{m\omega^2}}$ .

27. If free end is pulled downward then :
- Linear momentum and mechanical energy of block will remain conserved.
  - Linear momentum and angular momentum of block will remain conserved.
  - Angular momentum of block will remain conserved.
  - Mechanical energy of block will remain conserved.
28. If at free end a block of same mass is suspended instead of applying force then with what angular velocity the block should move on same circular path to make the hanging block at rest :
- $\sqrt{\frac{mg}{F}}$
  - $\sqrt{\frac{F}{mg}}$
  - $\omega\sqrt{\frac{mg}{F}}$
  - $\frac{\omega}{2}\sqrt{\frac{mg}{F}}$
29. Which of the following statements is correct :
- Radial acceleration of block is zero.
  - Tangential acceleration of block is zero while radial acceleration is  $\frac{F}{m}$ .
  - Radial acceleration of block is  $\frac{F}{2m}$
  - Net acceleration of block is zero.
30. If force at free end of string is increased to twice then to maintain the circular path of same radius the angular velocity of block must be increased by :
- 100%
  - 141.4%
  - 41.4%
  - 50%.

## CHEMISTRY

31. In which of the following molecules, the resonance effect is not present ?
- 
  - 
  - 
  - 
32. The order of reactivity of halogens towards halogenation of alkanes is
- $F_2 > Br_2 > Cl_2$
  - $F_2 > Cl_2 > Br_2$
  - $Cl_2 > F_2 > Br_2$
  - $Cl_2 > Br_2 > F_2$
33. The treatment of  $CH_3OH$  with  $CH_3MgI$  releases 1.04 mL of a gas at STP. The mass of  $CH_3OH$  added is :
- 1.49 mg
  - 2.98 mg
  - 3.71 mg
  - 4.47 mg .