



Date :-04/02/2022

Time :-50 Minutes

Exam Name :-IIT-JEE-  
1to1Guru-4

Mark :- 84

### PHYSICS

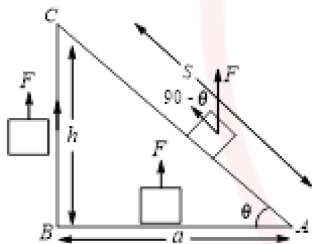
1. For a certain thermocouple the emf is  $E = aT + bT^2$ , where  $t$  (in  $^{\circ}\text{C}$ ) is the temperature of hot junction, the cold junction is at  $0^{\circ}\text{C}$ . The value of constants  $a$  and  $b$  are  $10 \times 10^{-6}$  and  $0.02 \times 10^{-6}$  respectively, then the temperature of inversion (in  $^{\circ}\text{C}$ ) will be

(a) 150 (b) 250 (c) 500 (d) 750

2. Avalanche breakdown is due to

- (a) Collision of minority charge carrier  
(b) Increase in depletion layer thickness  
(c) Decrease in depletion layer thickness  
(d) None of these

3. If we shift a body in equilateral from  $A$  to  $C$  in a gravitational field via path  $AC$  or  $ABC$ ,



(a) The work done by force  $\vec{F}$  for both paths will be same

(b)  $W_{AV} > W_{ABC}$  (c)  $W_{AC} < W_{ABC}$ 

(d) None of the above

4. Which of the following expressions corresponds to simple harmonic motion along a straight line, where  $x$  is the displacement and  $a, b, c$  are positive constants? [Online April 12, 2014]

(a)  $a + bx - cx^2$  (b)  $bx^2$  (c)  $a - bx + cx^2$ (d)  $-bx$ 

5. A block of weight  $W$  rests on a horizontal floor with coefficient of static friction  $\mu$ . It is desired to make the block move by applying minimum amount of force. The angle  $\theta$  from the horizontal at which the force should be applied and magnitude of the force  $F$  are respectively. [Online May 19, 2012]

(a)  $\theta = \tan^{-1}(\mu), F = \frac{\mu W}{\sqrt{1+\mu^2}}$ (b)  $\theta = \tan^{-1}\left(\frac{1}{\mu}\right), F = \frac{\mu W}{\sqrt{1+\mu^2}}$  (c)  $\theta = 0, F = \mu W$ (d)  $\theta = \tan^{-1}\left(\frac{\mu}{1+\mu}\right), F = \frac{\mu W}{1+\mu}$ 

### NUMERIC QUESTIONS

6. A small body of mass  $m$  is connected to two horizontal springs of elastic constant  $k$ , natural length  $3d/4$ . In the equilibrium position both springs are stretched to length  $d$ , as shown figure. What will be the ratio of period of the motion ( $T_b/T_a$ ) if the body is displaced horizontally by a small distance where  $T_a$  is the time period when the particle oscillates along the line of springs and  $T_b$  is time period when the particle oscillates perpendicular to the plane of the figure? Neglect

effects of gravity



7. There are two radio nuclei A and B. A is an alpha emitter and B a beta emitter. Their disintegration constants are in ratio of 1 : 2. The ratio of number of atoms of A and B at any time  $t$  so that probabilities of getting alpha and beta particles are same at that instant is -

### CHEMISTRY

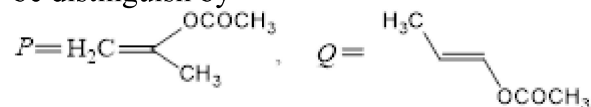
8. Consider the following reactions I:  $\text{AlH}_3 + \text{H}^- \rightarrow \text{AlH}_4^-$  II:  $\text{H}_2\text{O} + \text{H}^- \rightarrow \text{H}_2 + \text{OH}^-$  Select the correct statements based on these reactions

- (a)  $\text{H}^-$  is a Lewis acid in I and Lewis base in II  
(b)  $\text{H}^-$  is a Lewis base in I and Bronsted base in II  
(c)  $\text{H}^-$  is a Lewis acid in I and Bronsted acid in II  
(d)  $\text{H}^-$  is a Lewis base in I and II

9. One of the following metals is obtained by leaching its ore with dilute cyanide solution. Identify it.

(a) Titanium (b) Vanadium (c) Silver (d) Zinc

10. The product of acid hydrolysis of  $P$  and  $Q$  can be distinguish by



- (a) Lucas reagent (b) 2, 4-DNP  
(c) Fehling's solution (d)  $\text{NaHSO}_3$

11. Partial pressure of  $\text{O}_2$  in the reaction  $2\text{Ag}_2\text{O}(s) \rightleftharpoons 4\text{Ag}(s) + \text{O}_2(g)$  is

(a)  $K_p$  (b)  $\sqrt{K_p}$  (c)  $3\sqrt{K_p}$  (d)  $2K_p$

12. The mole fraction of solute in one molal aqueous solution is:

(a) 0.009 (b) 0.018 (c) 0.027 (d) 0.036

### NUMERIC QUESTIONS

13. One mole of a Vanderwaals gas at 300 K expands isothermally and reversibly from volume 10.064 L to 50.064 L. Vanderwaals constant  $a = 5 \text{ lit}^2 \text{ atm mol}^{-2}$  and  $b = 0.064 \text{ L/mole}$   $\log 3 = 0.48$  ;  $\log 2 = 0.3$  ;  $\log 5 = 0.7$  Determine the work done by the system in J/mole in nearest possible integers.

14. Effective atomic number (EAN) of Fe in brown ring complex  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$

### MATHEMATICS

15. If the AM and GM of roots of a quadratic equations are 8 and 5 respectively, then the quadratic equation will be

(a)  $x^2 - 16x - 25 = 0$  (b)  $x^2 - 8x + 5 = 0$

(c)  $x^2 - 16x + 25 = 0$  (d)  $x^2 + 16x - 25 = 0$

16. Equation of chord of the parabola  $y^2 = 16x$  whose mid point is (1, 1), is

(a)  $x + y = 2$  (b)  $x - y = 0$  (c)  $8x + y = 9$

(d)  $8x - y = 7$

17. The tangents from a point  $(2\sqrt{2}, 1)$  to the hyperbola  $16x^2 - 25y^2 = 400$  include an angle equal to

(a)  $\pi/2$  (b)  $\pi/4$  (c)  $\pi$  (d)  $\pi/3$

18. The coefficient of  $x^{-10}$  in  $(x^2 - \frac{1}{x^3})^{10}$  is

(a) -252 (b) 210 (c) -(5!) (d) -120

19. The number of discontinuities of the greatest integer function  $f(x) = [x], x \in (-\frac{7}{2}, 100)$  is equal to

(a) 104 (b) 100 (c) 102 (d) 103

### NUMERIC QUESTIONS

20. In  $\Delta ABC$ ,  $AB = 1$ ,  $BC = 1$  &  $AC = \frac{1}{\sqrt{2}}$ . In  $\Delta MNP$ ,  $MN = 1$ ,  $NP = 1$  &  $MNP = 2 \Delta ABC$ . Then side MP equals  $\frac{\sqrt{k^3 - 1}}{k}$  find k

21. If  $\vec{a}, \vec{b}, \vec{c}$  are non-coplanar vectors and  $\vec{a}, \vec{b}, \vec{c}$  form reciprocal system of  $\vec{a}', \vec{b}', \vec{c}'$  respectively then find the value of  $(\vec{a} + \vec{b}) \cdot \vec{a}' + (\vec{b} + \vec{c}) \cdot \vec{b}' + (\vec{c} + \vec{a}) \cdot \vec{c}'$ .