**RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA**
**Undergraduate Admission Test 2023:** Physics Honours

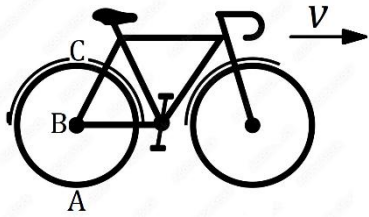**Full Marks : 75**                                                                    **Time : 1 hour**

1. The velocity 'v' of a particle at time 't' is given by $v = at + \dfrac{b}{t+c}$, the dimensions of (abc) is
   a) $[L^2T^{-1}]$
   b) $[LT^{-1}]$
   c) $[LT^{-2}]$
   d) $[LT]$

2. A particle is describing a motion on $x - y$ plane such that its coordinates evolve with time $(t)$ according to following relations: $x(t) = t\cos(t)$ and $y(t) = t\sin(t)$. Trajectory of the particle is,
   a) A circle
   b) An ellipse
   c) A spiral inward
   d) A spiral outward

3. A bicycle is moving with speed of $v$ as shown in the figure. Consider three points A, B and C on its rear wheel. If, linear velocity of these points are $v_A, v_B$ and $v_C$ respectively, then, which one of the following options is correct?
   a) $v_A = v_B = v_C = v$
   b) $v_C = -v_A = v$ and $v_B = 0$
   c) $v_A = 0$ and $v_B = v_C/2 = v$
   d) $v_B = v_C = -v_A = v$

4. A hole is bored at a depth $h$ on the side wall of a tank filled with water. The velocity of water coming out of the hole is proportional to,
   a) $h$
   b) $h^2$
   c) $\sqrt{h}$
   d) Independent of $h$

5. A bigger drop is broken into a large number of smaller drops. The process is
   a) exo-thermic
   b) endo-thermic
   c) neither exo-thermic nor endo-thermic
   d) cannot be said

6. Coefficients of linear expansion of an anisotropic solid along three rectangular axes in the solid are $\alpha_x$, $\alpha_y$ and $\alpha_z$ . Coefficient of cubical expansion of the solid is
   a) $\alpha_x + \alpha_y + \alpha_z$
   b) $[\alpha_x \alpha_y \alpha_z]^{1/3}$
   c) $\dfrac{\alpha_x + \alpha_y + \alpha_z}{3}$
   d) None

7. Temperature of an ideal gas changes from 27°C to 927°C. The r.m.s. speed of its molecules becomes
   a) Four times
   b) Twice
   c) Half
   d) Thrice

8. Two identical metallic balls (A & B) in a room are heated up to increase their temperature by same amount so that their radii are increased by 1%. The ball A is resting on the floor and the ball B is hanging from the ceiling by a very thin wire so that the heat loss through their points of contact, in both the cases, is negligible. If the heat absorbed by the ball A and B are $Q_A$ and $Q_B$, respectively then in principle:
   a) $Q_A > Q_B$
   b) $Q_A = Q_B$
   c) $Q_A < Q_B$
   d) $Q_A$ and $Q_B$ cannot be compared

9. A monatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16V. The final pressure of the gas is (take $\gamma = 5/3$) :
   a) 64P
   b) 32P
   c) P/64
   d) 16P

10. The ratio of frequencies of two simple pendulums is 2:3, then ratio of their lengths is,
    a) $\sqrt{2} : \sqrt{3}$
    b) $\sqrt{3} : \sqrt{2}$
    c) 9:4
    d) 4:9

11. The respective numbers of the significant figures for the numbers 28.028, 0.0004 and $1.2*10^{-3}$ are:
    a) 5,1,2
    b) 5,1,3
    c) 4,4,2
    d) 5,5,2

12. The equation of a progressive wave is given by $y = 15\cos(660\pi t - 0.02\pi x)$ cm. The frequency of the wave is -
    a) 330 Hz
    b) 342 Hz
    c) 365 Hz
    d) 660 Hz

13. Two light waves whose intensities are 9:16 are made to interfere. The ratio of maximum and minimum intensities in the interference pattern is
    a) 49:16
    b) 49:1
    c) 7:1
    d) 4:3

14. A capacitor is charged with a battery and energy stored is $U$. After disconnecting the battery another capacitor of the same capacity is connected in parallel with it. The energy stored in each capacitor is,
    a) $U/2$
    b) $U/4$
    c) $2U$
    d) $4U$

15. The force of repulsion between two electrons at a certain distance is $F$. The force between two protons separated by the same distance is ($m_p = 1836m_e$)
    a) $2F$
    b) $F$
    c) $1836F$
    d) $F/1836$

16. A wire of uniform cross-section and resistance R is cut into ten equal pieces. If two such pieces are connected in parallel then equivalent resistance will be
    a) $R/5$
    b) $R/10$
    c) $R/20$
    d) $2R$

17. The magnetic field at a distance $r$ from a straight long wire carrying current $I$ is **0.4T**. The magnetic field at a distance $2r$ is
    a) $0.2T$
    b) $0.1T$
    c) $0.05T$
    d) $0.4T$

18. What is the direction of the magnetic field inside a solenoid when an electric current flows through it,
    a) Along the axis of the solenoid
    b) Anti-clockwise
    c) Alternating direction
    d) No magnetic field is produced inside a solenoid

19. According to Ampere's circuital law, the magnetic field produced by a current-carrying conductor is directly proportional to,
    a) The length of the conductor
    b) The current flowing through the conductor
    c) The resistance of the conductor
    d) The voltage applied to the conductor

20. If the kinetic energy of a free electron doubles, it's de-Broglie wavelength changes by a factor,
    a) 2
    b) ½
    c) $\sqrt{2}$
    d) $1/\sqrt{2}$

21. Sodium and Copper have work functions 2.3 $eV$ and 4.5 $eV$ respectively. Then the ratio of the wavelength is nearest to,
    a) 1:2
    b) 4:1
    c) 2:1
    d) 1:4

22. If radius of the $^{27}_{13}Al$ nucleus is estimated to be 3.6 $fermi$ then the radius of $^{125}_{52}Te$ nucleus be nearly,
    a) 8 fermi
    b) 6 fermi
    c) 5 fermi
    d) 4 fermi

23. If input voltage, $V_{in}$=5 sin ($\omega$t) where $\omega$ is the angular frequency then (Assume ideal diode approximation, i.e., cut-in voltage of the diode is 0V) :
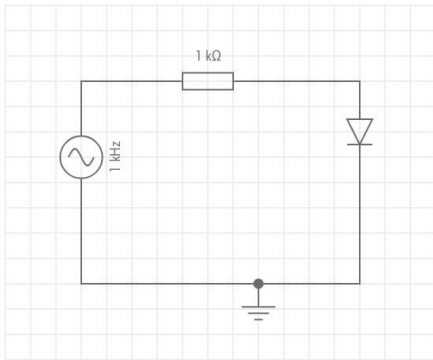


    a) During positive half cycle voltage drop across the diode = $V_{in}$
    b) During negative half cycle voltage drop across the diode = 0 V
    c) During positive half cycle voltage drop across the resistance = 0 V
    d) During negative half cycle voltage drop across the diode = $V_{in}$

24. The equivalent resistance between $a$ and $b$ must be :



    a) 20 kΩ
    b) 10 kΩ
    c) 30 kΩ
    d) 13 kΩ
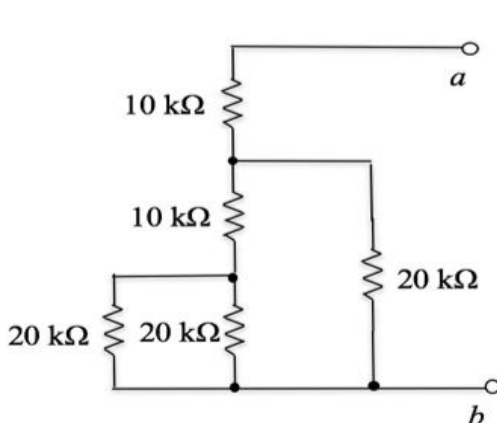
**25.** The key is closed at time t = 0. The current flowing through the capacitor 0.5 milliseconds after closing the key must be (capacitor is uncharged at t = 0) :
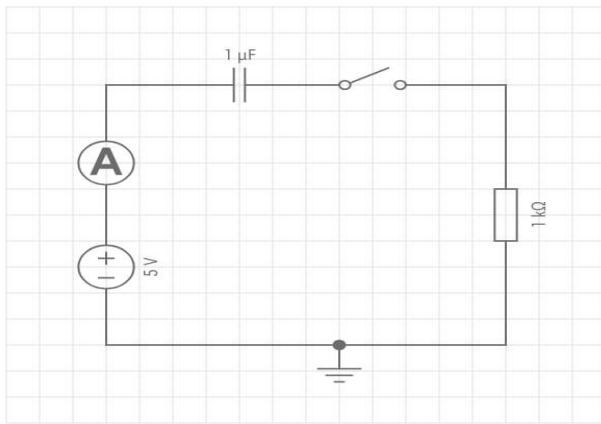


a) is more than 5 mA but less than 10 mA
b) is 0
c) is 5 mA
d) is less than 5 mA but greater than 0

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