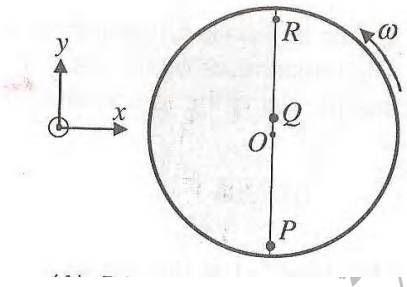
PAPER - II
PHYSICS

1. Consider a dise rotating in the horiszontal plane with a constant angular speed ω about its centre O. The disc has a shaded region on one side of the diametere and an unshaded region on the other side as shown in the figure. When the disc is in the orientation as shown, two pebbles P and Q are simultaneously projected at an angle towards R. The velocity of projection is in the y-z plane and is same for both pebbles with respect to the disc. Assume that (i) they land back on the disc before the disc has completed $\frac{1}{8}$ rotation, (ii) their range is less than half the disc radius, and (iii) ω remains constant throughout. Then



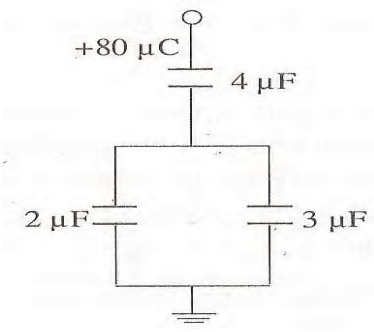
(a*) P lands in the shaded region and Q in the unshaded region

(b) P lands i nteh unshaded region and Q in the shaded region.

(c) Both P and Q land in the unshaded region.

(d) Both P and Q land in the shaded region

2. In the given circut, a charge of +80 μC is given to the upper plate of the 4 μC capacitor. Then in the steady state, the charge on the upper plate of the 3 μC capacitor is



(a) +32 μC (b) +40 μC

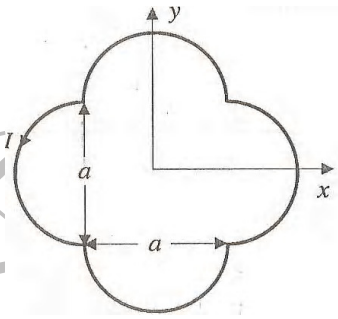
(c*) +40 μC (d) +80 μC

3. Two moles of ideal helium gas are in a rubber ballon at $30^0 C$. The balloon is fully expandable and can be assumed to require no energy in its expansion. The temperature of the gas in the ballon is slowly changed to $35^0 C$. The amount of heat required in raising the temperature is nearly (take R = 8.31 J/mol.K)

(a) 62 J (b) 104 J

(c) 124 J (d*) 208 J

4. A loop carrying current I lies in the x-y plane as shown in the figure. The unit vector $\hat{k}$ is coming out of the plane of the paper. The magnetic moment of the current loop is



(a) $a^2 I\hat{k}$ (b*) $\left(\frac{\pi}{2}+1\right)a^2 I\hat{k}$

(c) $-\left(\frac{\pi}{2}+1\right)a^2 I\hat{k}$ (d) $(2\pi+1)a^2 I\hat{k}$

5. Two identical discs of same radius R are rotating about their axes in opposite directions with the same constant angular speed ω. The discs are in the same horizontal plane. At time $t=0$, the points P and Q are figure. The relative speed between the two points P and Q is v_r. In one time period (T) of rotation of the discs, v_r as a function of time is best represented by