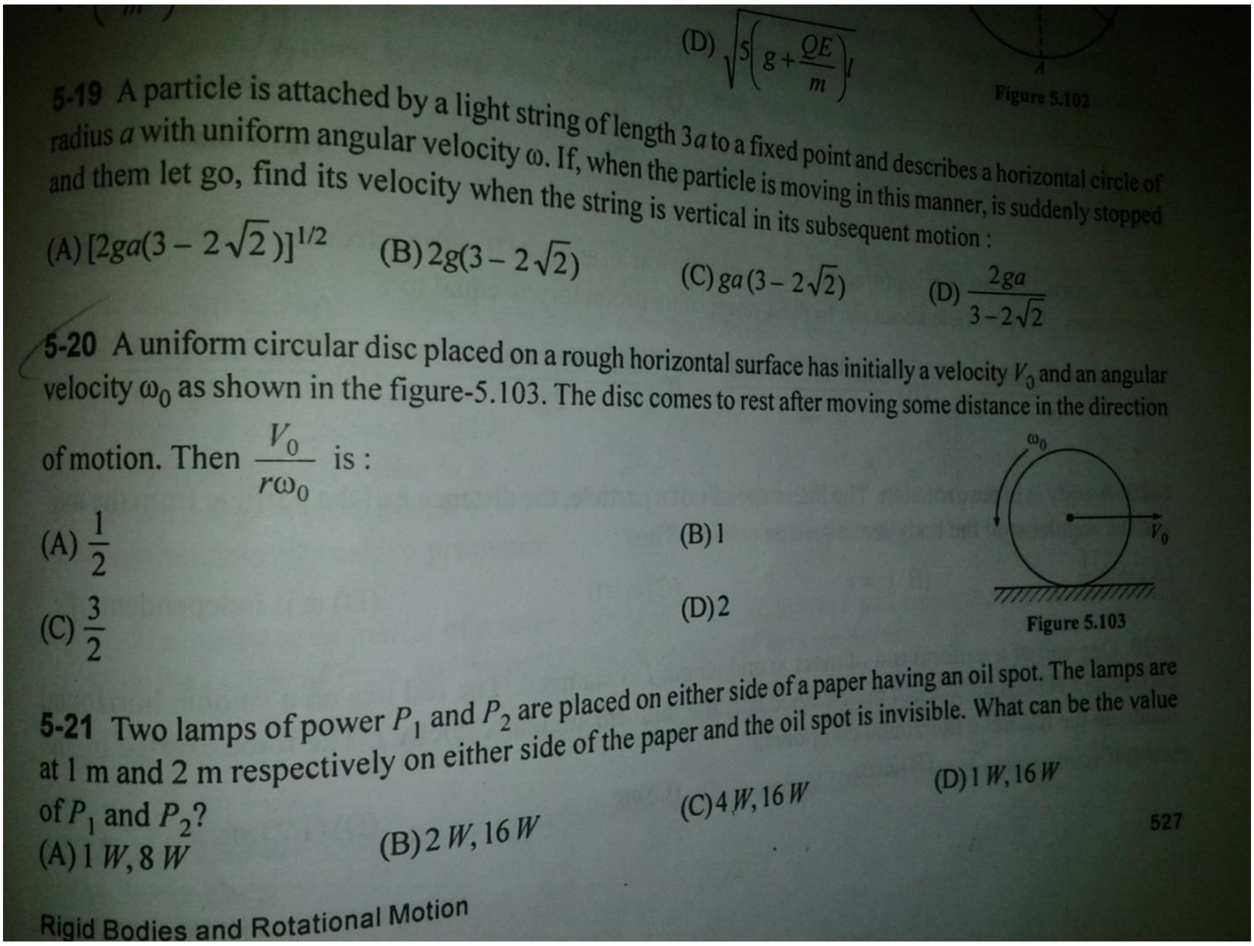
Answer on Question#56570 - Physics - Mechanics - Relativity



(D) $\sqrt{5\left(g+\frac{QE}{m}\right)l}$

Figure 5.102

5-19 A particle is attached by a light string of length $3a$ to a fixed point and describes a horizontal circle of radius a with uniform angular velocity ω. If, when the particle is moving in this manner, is suddenly stopped and them let go, find its velocity when the string is vertical in its subsequent motion :

(A) $[2ga(3-2\sqrt{2})]^{1/2}$ (B) $2g(3-2\sqrt{2})$ (C) $ga(3-2\sqrt{2})$ (D) $\frac{2ga}{3-2\sqrt{2}}$

5-20 A uniform circular disc placed on a rough horizontal surface has initially a velocity V_0 and an angular velocity ω_0 as shown in the figure-5.103. The disc comes to rest after moving some distance in the direction of motion. Then $\frac{V_0}{r\omega_0}$ is :

(A) $\frac{1}{2}$ (B) 1

(C) $\frac{3}{2}$ (D) 2

Figure 5.103

5-21 Two lamps of power P_1 and P_2 are placed on either side of a paper having an oil spot. The lamps are at 1 m and 2 m respectively on either side of the paper and the oil spot is invisible. What can be the value of P_1 and P_2?

(A) 1 W, 8 W (B) 2 W, 16 W (C) 4 W, 16 W (D) 1 W, 16 W

527

Rigid Bodies and Rotational Motion

<u>Solution:</u>

(19) When it just let go the particle is $\sqrt{(3a)^2-a^2}=2\sqrt{2}a$ below the suspension point. When the string is vertical it is $3a$ below the suspension point. As the particle moves from the starting point to the lowest, it's potential energy converts into the kinetic energy and according to the law of conservation of energy the kinetic energy at the lowest point (string I vertical) equals to the potential difference between the starting and the lowest points:

$$\frac{mv^2}{2}=mg3a-mg2\sqrt{2}a,$$

Where v – is the speed of the particle at the lowest point. Thus

$$v=\sqrt{2ga\left(3-2\sqrt{2}\right)}$$

(20) The acceleration of the disk a and it's angular acceleration α are related by

$$a=\alpha r$$

Since $a=\frac{dv}{dt}$ and $\alpha=\frac{d\omega}{dt}$, we obtain

$$dv=rd\omega$$

Integrating this equation from the initial position ($v=v_0$ and $\omega=\omega_0$) to the final ($v=0$ and $\omega=0$) we obtain

$$v_0=r\omega_0$$

Thus

$$\frac{v_0}{r\omega_0} = 1$$

Answer:

(19) (A)

(20) (B)