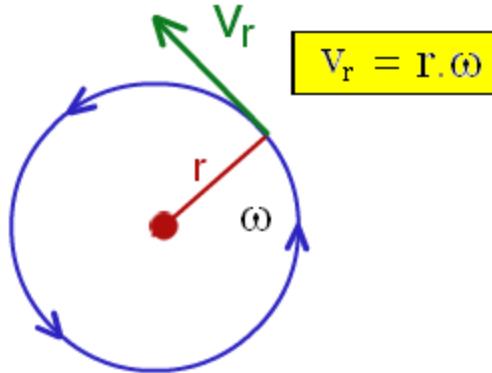


Answer on Question #45435, Physics, Mechanics | Kinematics | Dynamics

What is the tangential velocity of a point on the equator of Mercury which has a rotation period of 59 days and an equatorial radius of 2500 km?

Solution:

When a body is moving in circular path at a distance r from its center its velocity at any instant will be directed tangentially. This is what we call tangential velocity. In simple words the linear velocity at any instant is its tangential velocity.



$$v_r = \omega r$$

where r is the radius of circular path and ω is the angular velocity.

If the object has one complete revolution then distance traveled becomes; $2\pi r$ which is the circumference of the circle object.

Time passing for one revolution is called period. The unit of period is second. T is the representation of period.

The equation of tangential speed becomes

$$v_r = \frac{2\pi r}{T}$$

Thus, in our case

$$T = 59 \text{ days} = 59 \cdot 24 = 1416 \text{ hours} = 1416 \cdot 3600 = 5097600 \text{ sec}$$

$$r = 2500 \text{ km} = 2500 \cdot 10^3 \text{ m}$$

$$v_r = \frac{2\pi r}{T} = \frac{2\pi \cdot 2500}{1416} = 11.09 \frac{\text{km}}{\text{h}} = 39.94 \text{ m/s}$$

Answer: $v_r = 11.1 \text{ km/h} \approx 40 \text{ m/s}$.