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Question:

The crank and connecting rod of steam engine are 0.5m and 2m long respectively. The crank makes 180r.p.m. in clockwise direction. When it has turned through 45° from I.D.C. Find the velocity of piston and angular velocity of connecting rod by relative velocity method.

Answer:

Relative Velocity Method.

Given Data:

Crank = 0.5m

Connecting rod = 2m

N = 180 rpm

$\theta = 45^\circ$

A) Space diagram:

Scale:

1cm = 0.25m



$$\omega = \frac{2\pi N}{60}$$
$$\frac{2\pi \times 180}{60}$$

$$\omega = 18.84 \text{ rad/s}$$

Calculations:

velocity diagram
scale
1cm = 3 m/s

$$1) V_{OA} = r\omega$$

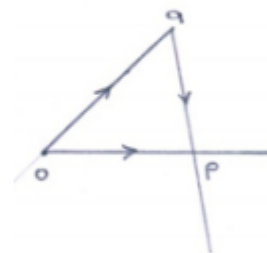
$$= 0.5 \times 18.84$$

$$V_{OA} = 9.42 \text{ m/s} \dots 1 \text{ mark}$$

B) Velocity diagram:

Scale:

1 cm = 3m/s



2) Velocity of piston:

$$V_p = L(OP) \times \text{scale}$$

$$= 2.8 \times 3$$

$$V_p = 8.4 \text{ m/s} \dots \text{ans}$$

3) Angular velocity of connecting rod:

$$\omega = \frac{V_{ap}}{\text{length of AP}} = \frac{l(ap) \times \text{Scale}}{2} = \frac{2.2 \times 3}{2}$$

$$\omega = 3.3 \text{ rad/sec} \dots \text{ans}$$