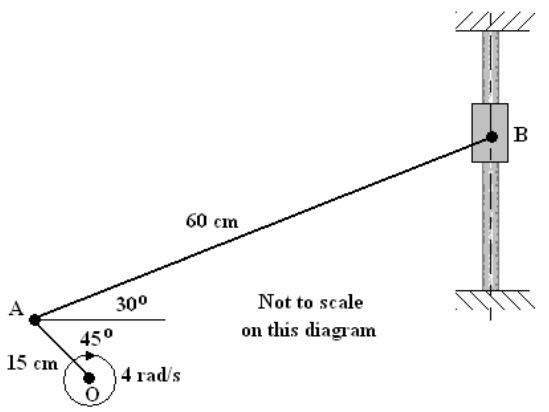
MECHANICAL AND STRUCTURAL ENGINEERING C105
EXAM QUESTIONS 2005 Q7

In the link mechanism shown the crank OA rotates clockwise about the fixed point O at a constant angular speed of 4 rad/s. The link AB is pinned to the slider B which is constrained to move vertically along the rigid guide. The unlettered instantaneous velocity diagram for the given condition is also shown. Determine
(a) The velocity of the slider B.
(b) The angular velocity of the link AB.
(c) Sketch the resulting instantaneous acceleration diagram for the mechanism. Stating clearly which acceleration components are being shown.
(d) Determine the rate of change of velocity of the slider B, stating whether it is positive or negative.

If you wish to draw the acceleration diagram to scale you are advised to start at the point O on the work sheet and use a scale of 1 cm = 0.2 m/s^2



Velocity of A relative to O is $(v_A)_O = \omega\, r = 4 \times 0.15 = 0.6$ m/s
Scaling from the velocity diagram the velocity of the slider $(V_B)_O = 1.16$ m/s
The velocity of B relative to A is $(v_B)_A = 0.85$ m/s
The angular velocity of the link is hence $\omega = v/r = 0.85/0.6 = 1.417$ rad/s

ACCELERATION VALUES

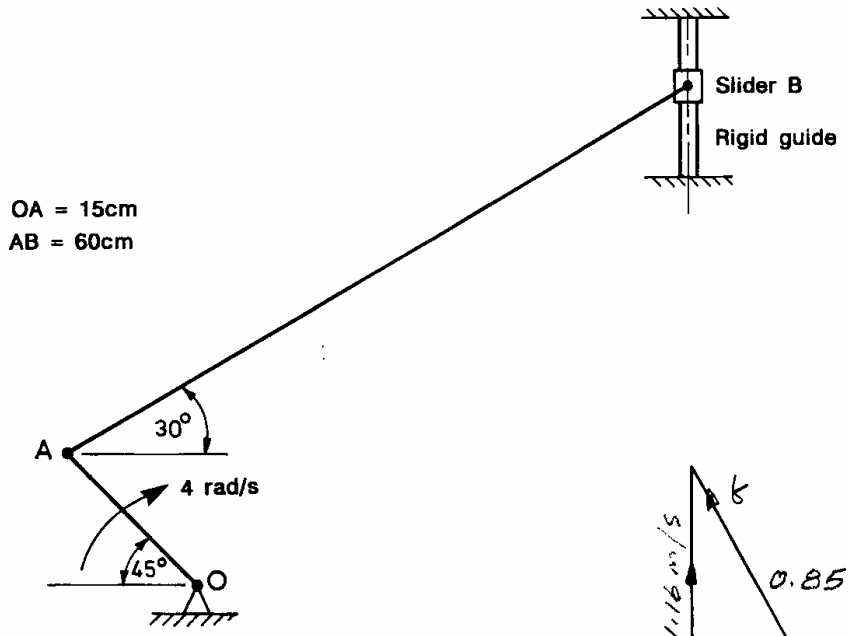
Centripetal acceleration of A relative to O is $(a_A)_O = \omega^2 r = 4^2 \times 0.15 = 2.4$ m/s^2
Centripetal acceleration of B relative to A is $(a_B)_A = \omega^2 r = 1.417^2 \times 0.6 = 1.2$ m/s^2
Drawing the acceleration diagram yields the acceleration of the link is 1.1 m/s^2
Note the direction can only be vertical and that the tangential acceleration line must intersect so the point b_2 is fixed on the diagram.

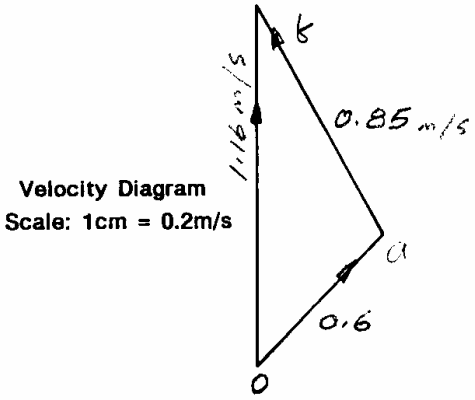
The completed worksheet is on the next page.

TO BE DETACHED AND INSERTED INTO YOUR ANSWER BOOK

Worksheet Q7

Candidate No. | | | | | |





Velocity Diagram
Scale: 1cm = 0.2m/s