3 In a machine, a peg that is fixed to a wheel rotates in a vertical circle of radius r. Both the peg and the wheel rotate with a constant angular velocity ω and period T about the centre of wheel O. The peg is in contact with a horizontal slot in a yoke. As the peg undergoes uniform circular motion, the yoke of mass m moves vertically up and down within a well.

Fig. 3.1 shows the positions of the peg and yoke at different times t.

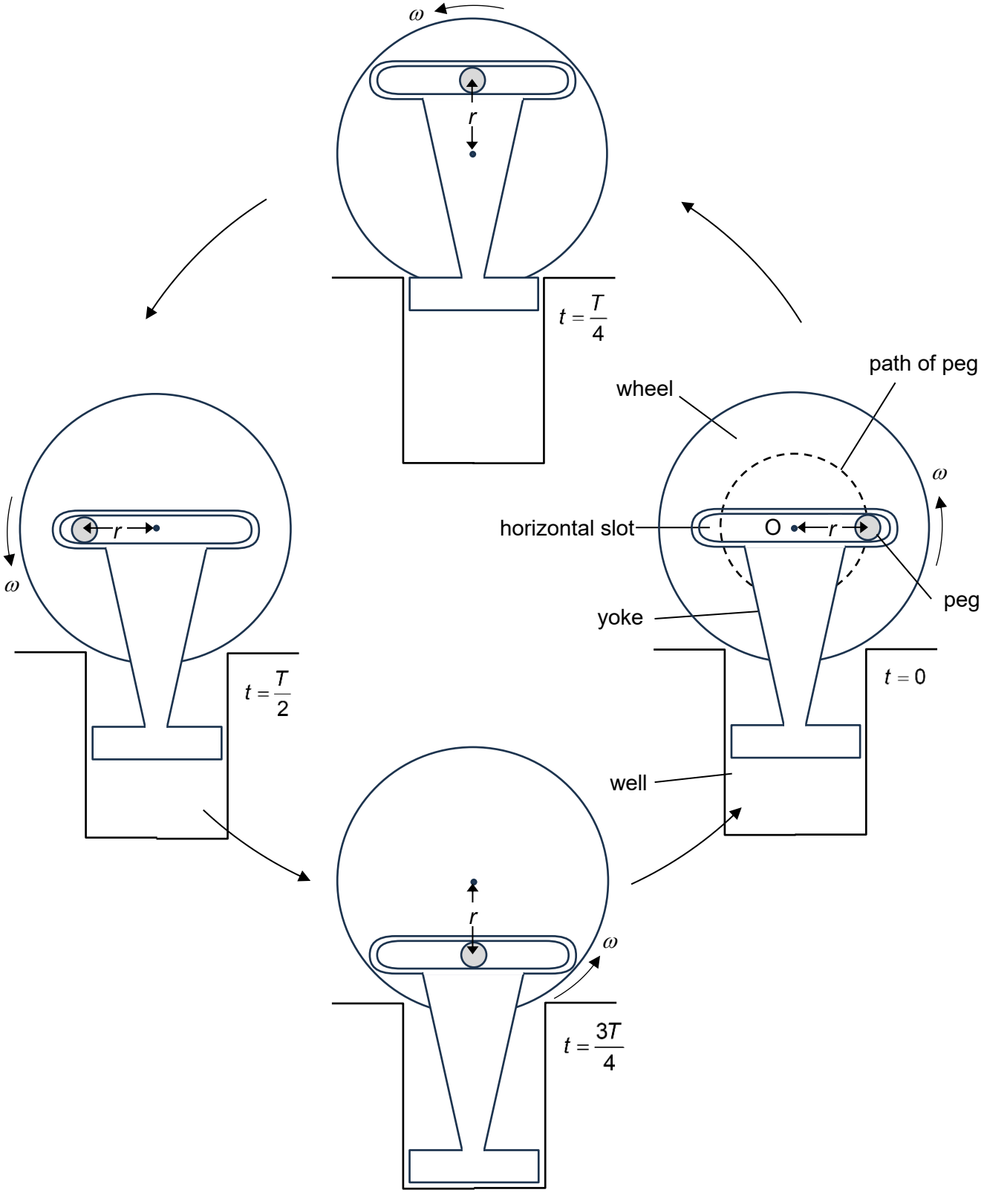

Fig. 3.1

(a) State and explain the motion of the yoke.

.....

.....

.....

..... [2]

(b) Given that r = 0.080 m, T = 0.40 s and m = 0.30 kg, determine:

(i) **1.** the maximum speed v_0 of the yoke

v_0 = ... m s^{-1} [2]

2. the maximum acceleration a_0 of the yoke.

a_0 = ... m s^{-2} [2]

(ii) On Fig. 3.2, sketch a line to show the variation of net force F on the yoke with time t. Take the equilibrium position of the yoke as the zero of displacement and the upwards direction as positive.

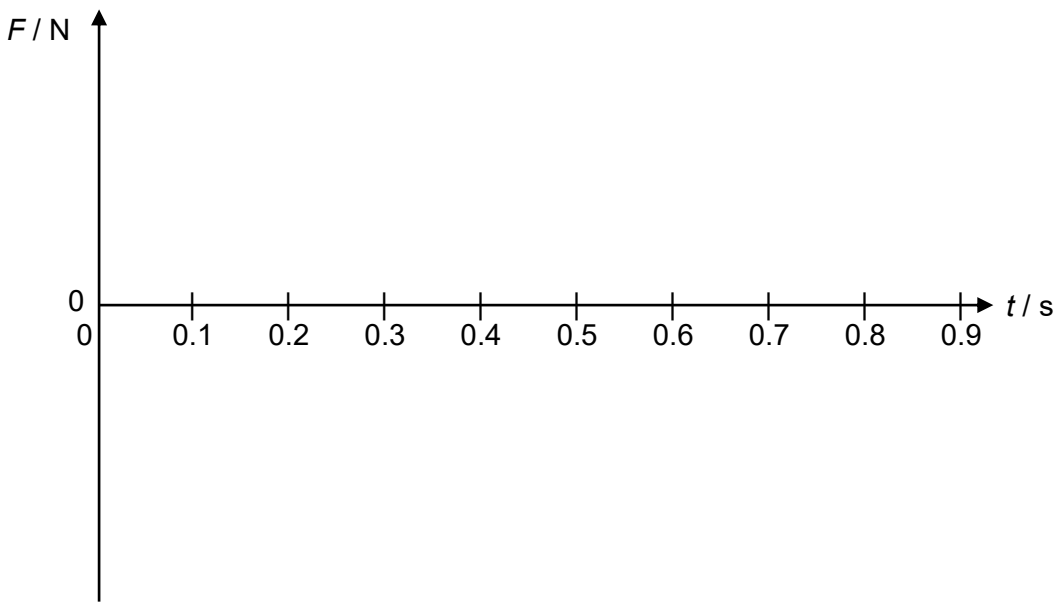

Fig. 3.2

[3]

[Total: 9]