Name of the Student:_____

Max. **Marks : 17 Marks**   **Time : 17 Minutes**

Q1.

A student investigates moments of forces.

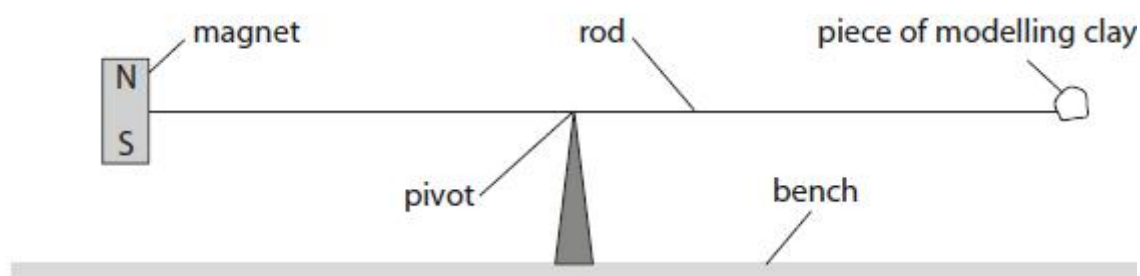Figure 14 shows the apparatus used.

Figure 14

The pivot is under the centre of the rod.

A magnet is fixed to one end of the rod.

A piece of modelling clay is fixed to the other end of the rod.

The system is in equilibrium.

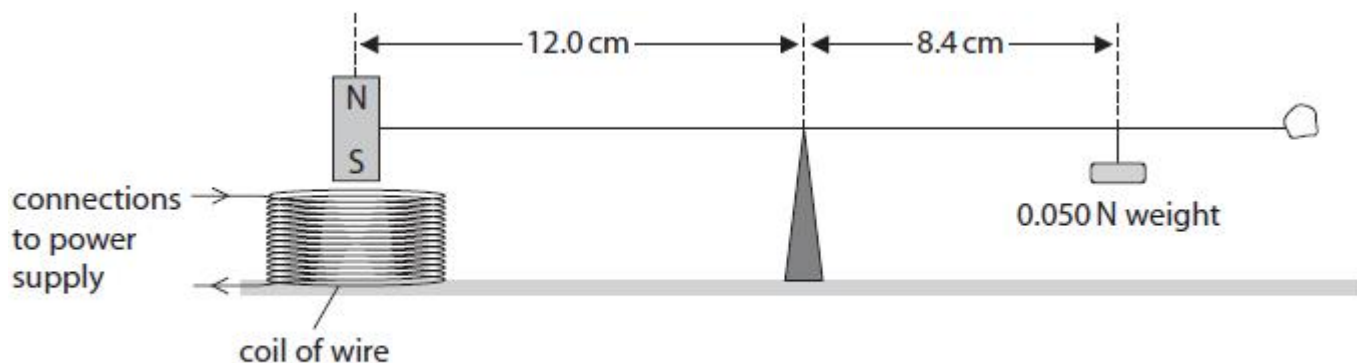(a) The student fixes a coil to the bench under the magnet as shown in Figure 15.

Figure 15

The coil of wire is connected to a d.c. power supply so that there is a current in the coil.
To bring the system back into equilibrium, the student hangs a 0.050 N weight on the rod, 8.4 cm away from the pivot, as shown in Figure 15.
Calculate the size of the force between the magnet and the coil.

(3)

force = ... N

(b) Describe how the student could develop the investigation to determine if the size of the force between the magnet and the coil is directly proportional to the size of the current in the coil.

(4)

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(Total for question = 7 marks)

Q2.

Figure 14 show a rack and pinion system, used on a mountain railway.

pinion   rack
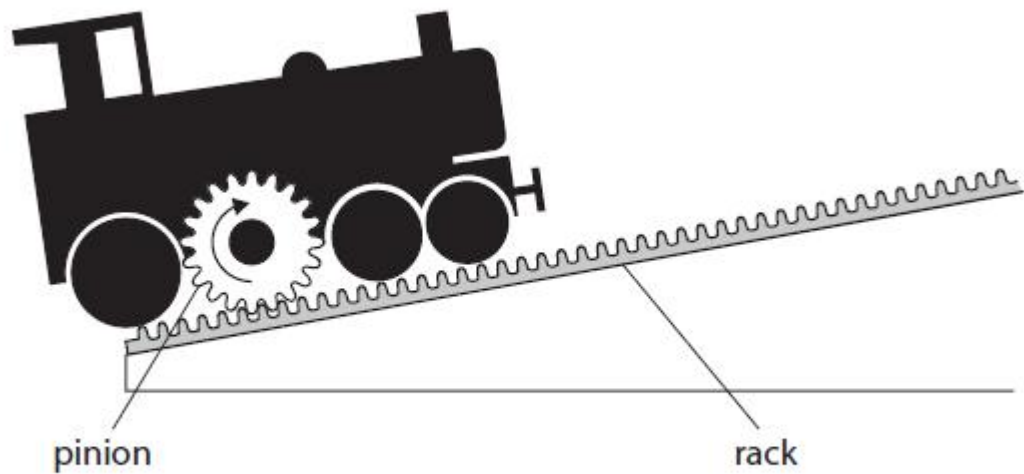
Figure 14

The teeth on the rack are 8.0 cm apart.

Calculate how far along the rack the train moves when the pinion turns through one complete revolution.

(2)

distance = ... m

(Total for question = 2 marks)

Q3.

Figure 3 is a diagram of the forces acting on a swing.
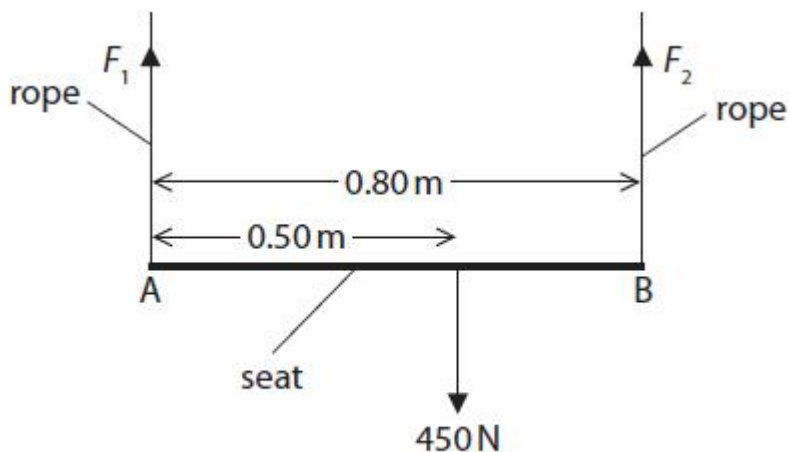
The swing is not moving.

Figure 3

The seat of the swing, AB, is 0.80 m long.

A person of weight 450 N sits on the seat.

The person's weight acts at a distance of 0.50 m from A as shown in Figure 3.

Ignore the weight of the seat.

The upward forces exerted by the ropes on the seat are F_1 and F_2.

Calculate the force F_2 by taking moments about A.

(3)

force F_2 = ... N

(Total for question = 3 marks)

Q4.

Figure 8 shows a bicycle.
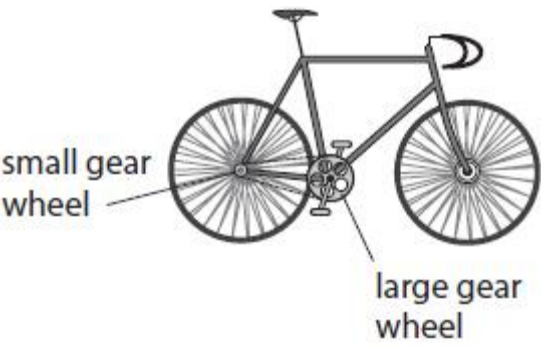

small gear wheel

large gear wheel

Figure 8

(i) The rider uses the pedals to make the large gear wheel turn.

The large gear wheel moves the chain.
The chain turns the small gear wheel.
The large gear wheel has 48 teeth.
The small gear wheel has 12 teeth.
The large gear wheel turns 2 times each second.
Calculate the number of times that the small gear wheel turns each second.

(2)

.... turns each second

(ii) Oil is applied to the wheel of a bicycle at the point shown in Figure 9.

oil applied here
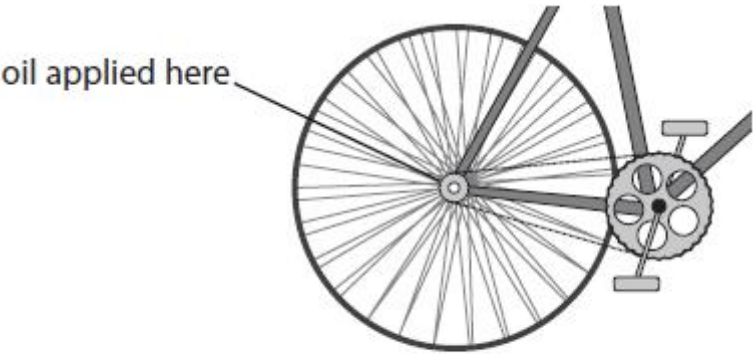
Figure 9

Explain how the oil improves the efficiency of the bicycle.

(3)

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(Total for question = 5 marks)