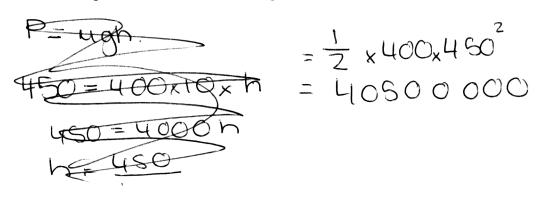**Section II (continued)**

Marks

Question 13 — Personal and Public Transport (10 marks)

A railway track has rails made of 0.8% carbon steel.

(a) The surface of the rails has been induction heated and water quenched. Describe the final structure and properties of the rail.

3

The surface of the rails are extremely hard and tough

It has a face centred cubic internal structure

(b) A suburban train weighing 400 tonnes has to climb a gradient of 1 in 50 at a constant velocity of 60 km per hour.

3

If the power required to overcome rolling resistance at this velocity is 450 kW, calculate the overall power needed to climb the gradient.

$P = \mu g h$

$450 = 400 \times 10 \times h$

$450 = 4000 h$

$h = 450$

$= \frac{1}{2} \times 400 \times 450^2$

$= 40500000$

Power = 40500000 kJ

Question 13 (continued)

(c)   (i)   Describe how an electric motor is used to convert electricity into rotary motion.   **2**

uses electromagnets to generate power into coil. the magnets then spin around the coil creating rotary motion.

(ii)   Describe TWO different applications of electrical motors that are used in transport systems.   **2**

• run air conditioners – turns a fan which produces air into a vehicle –
• ~~run electric cars.~~ – wind screen wipers → generates electricity to flip the wipers back and forth with a speed control

and can also generate heat which can be blown into the vehicle as well.

End of Question 13