

2003 HIGHER SCHOOL CERTIFICATE EXAMINATION
Engineering Studies

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 grains on the inside are large and normal but the grains on the outside are stressed because of the instant cooling. This causes the rail to be strong on the outside, not to get dints, but softer inside to absorb shocks.

- (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.

$$W = \frac{FS}{t}$$

Power =

Question 13 continues on page 16

Question 13 (continued)

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

The two magnets placed around a coil which has electricity flowing through it, because the wires have a magnetic field (caused by electricity) and they interact with the magnets' magnetic field to move.

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

Trains use electricity from the wires above to make their motors make the train move. The automatic doors on trains also use motors to make them open or close.

End of Question 13