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 of the rail would be distorted due to the quenching in water. They would remain as [redacted] Face Center - Cubic due to this and therefore become much stonger and brittle if not toughned

(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.

$P = \frac{W}{T}$

$= \frac{10000}{16.67}$

$= 599.88$

$T = \frac{60000}{3600}$

$= 16.67$

$P = ?$

$W =$ let W be 10000

Power = 599.88) OR 5.99 KJ

Question 13 continues on page 16

Marks

Question 13 (continued)

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

With two magnets placed either side and an electrical current flowing through it, causes a metal cylinder to roll around constantly and this is motion.

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

1) Trains – the electricity is gathered from powerlines above the tracks and converted into rotary motion

2) Fans in Cars are driven by the battery in the care to produce air conditioning

End of Question 13