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 structure will be equiaxed at the surface and then small toward the bottom of the rail. The final property of the rail will be a hard brittle surface with a more ductile core.

(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.

$Ke = \frac{1}{2}mv$

$= \frac{1}{2} \times 400 \times 60$

$= 12000$

Power = 12 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**

A electric motor turns a magnet in between a series of copper wires this rotary motion, convert electricall energy into kinetic enegy.

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

electric motors are used in all modern trians, which are very economical.
Modern lifts in high rise buildings also are powered by any electrical motor.

End of Question 13