



9 (a) Define, in words,

(i) *magnetic flux density*,

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(ii) the *tesla*.

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(b) Explain, using a labelled diagram, how a current balance is used to measure the flux density of a magnetic field.

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- (c) An electric motor is used in a train to provide its output power.

The e.m.f. of the supply is 600 V d.c. The resistance of the wires in the motor is $4.00\ \Omega$ and any energy transferred to heat in the wires is wasted. The voltage across the resistance of the wires can be calculated using $V = IR$. The rest of the 600 V supplied is used to turn the motor and to do useful work.

- (i) Complete the following table showing how the efficiency of the motor varies with the current from the supply. Efficiency is the ratio of the power output of the motor to the power supplied from the d.c. source.

current from supply / A	p.d. across resistance of wires / V	p.d. used to do useful work / V	power from the supply / kW	power wasted in resistance / kW	useful power output of motor / kW	percentage efficiency of motor
150	600	0	90	90	0	0
120					14.4	
90				32.4		
60			36			60
30		480				
10	40					

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- (ii) Suggest why it is impracticable to run the motor at maximum efficiency. Include in your answer, with reasons, a suggested practical running efficiency.

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[Total: 20]

