Transformers

1 A small notebook computer has a power rating of 40 W.
The computer is connected to the mains supply through a step-down transformer.
The mains supply is a.c.

(a) (i) How much energy is supplied to the computer each second?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** 0.025 J
- ☐ **B** 4.0 J
- ☐ **C** 40 J
- ☐ **D** 240 J

(ii) Sketch an alternating current on the axes shown.

(1)

(b) The step-down

- 2400 turns on the primary coil
- 200 turns on the secondary coil
- a primary voltage of 230 V.

Calculate the voltage output of the secondary coil.

(3)

secondary voltage = ... V

(c) (i) Explain how transformers are used to improve the efficiency of power transmission in the National Grid.

(3)

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(ii) Explain why flying a kite near power lines could be a danger to the person flying the kite.

(2)

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(Total for Question 4 = 10 marks)

2 The efficiency of an electric motor is investigated as shown in Figure 11.

The motor lifts a mass at a constant speed.

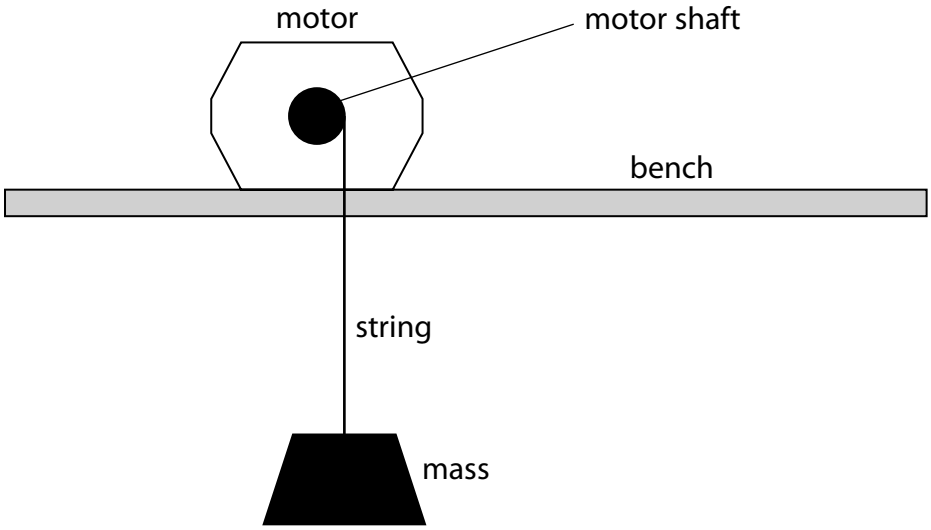

Figure 11

The results are shown in Figure 12.

current in motor	1.9 A
voltage across motor	10.0 V
time taken to lift mass	9.0 s

Figure 12

(a) (i) Which of these changes would improve the results?

(1)

- ☒ **A** Repeating the investigation with different masses
- ☒ **B** Repeating the readings and calculating averages
- ☒ **C** Using a motor that works with a higher voltage
- ☒ **D** Using a shorter piece of string to lift the mass

(ii) Which of these best shows the energy stores as the mass is lifted?

(1)

	kinetic energy of the mass	potential energy of the mass
☒ **A**	constant	increasing
☒ **B**	constant	decreasing
☒ **C**	decreasing	increasing
☒ **D**	decreasing	decreasing

(b) (i) Show that the total energy supplied to the motor in the 9 s is about 170 J.

(2)

(ii) During the 9 s the efficiency of the motor is 70%.

Calculate the amount of useful energy transferred in the 9 s.

Use the equation

$$\text{efficiency} = \frac{\text{useful energy transferred}}{\text{total energy supplied}}$$

(3)

useful energy = ... J

(c) Which row of the table is correct for the resistance of the motor?

(1)

	resistance of motor =	resistance of motor =
☒ **A**	$I \div V$	$I^2 \div P$
☒ **B**	$V \div I$	$P \div I^2$
☒ **C**	$V \div I$	$P \times I^2$
☒ **D**	$I \times V$	$P \div I^2$

(d) When the motor lifts the mass, the coil in the motor becomes warm.

Explain why the coil becomes warm.

(3)

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(Total for Question 5 = 11 marks)