Question 1 **D**

The number of squares is approximately 63.

$$\Delta\text{GPE} = 2000 \times 63 \times 0.2 \times 10^6$$
$$= 2.52 \times 10^{10} \text{ J}$$

The closest estimate to this is **D**.

Question 2 **B**

The right-hand slap rule is used for a positive charge. The thumb is up the page, the fingers are out of the page, the force is to the right. Reverse the direction of the force as it was a negatively charged object. Therefore the direction of the force is to the left.

Question 3 **C**

Using the right-hand slap rule, the force on the magnet is upwards. The reading on the scales will be less than 0.500 kg.

$$F = BIl$$
$$mg = BIl$$
$$m = \frac{BIl}{g}$$

$$\text{reading on the balance} = 0.500 - \frac{BIl}{g}$$

Question 4 **C**

Although the torque decreases in magnitude, the force maintains the same magnitude as PQ is always perpendicular to the field.

Question 5 **B**

When the magnet moves away from the coil, the external flux through the coil is to the left and decreasing. The coil reacts by providing its own flux to the left to account for the loss in external flux (Lenz law). Using the right-hand grip rule, the fingers point inwards and the current (thumb) on the front of the coil pushes upwards. Thus, the current flows from left to right through the resistor by following the wiring conventions.

Question 6 **D**

$$F_{\text{net}} = ma$$
$$F_{\text{D}} - F_f = ma$$
$$F_{\text{D}} - 1500 = 1200 \times 2$$
$$F_{\text{D}} = 2400 + 1500$$
$$= 3900 \text{ N}$$
$$= 3.9 \text{ kN}$$

