Question	Answer	Mark
1(a)(i)	Magnetic field at Y: 'towards the bottom of the page' ticked Force at Y: 'to the left' ticked	**B1** **B1**
(a)(ii)	There is a force on X because of the (magnetic) field caused by Y OR due to the (magnetic) field around / of Y OR the (magnetic) fields due to X and Y interacting	**B1**
(b)	Change in current / field is brief / for short time / occurs as switch closes Changing magnetic field / flux links with secondary coil / other coil / core OR field / flux lines cut coil Causes induced voltage / current	**B1** **B1** **B1**
		Total: 6

2 **(a) (i)** $(I =)P/V$ OR 18 000/120 OR 18/120   C1

        150 A   A1

    (ii) $(E =)Pt$ OR 18 000 × 30 × 60 OR 18 000 × 1800 OR 18 000 × 30 OR 5.4 × 10⁵   C1

2 **(a) (i)** $(I =)P/V$ OR 18 000/120 OR 18/120   C1

       150 A   A1

    (ii) $(E =)Pt$ OR $18\,000 \times 30 \times 60$ OR $18\,000 \times 1800$ OR $18\,000 \times 30$ OR 5.4×10^5 C1

       3.2×10^7 J OR 9.0 kWh   A

 (b) any three of:
   (high voltage means) low(er) current
   for given supply power
   (low(er) current means) less heat/thermal energy (generated in cables) OR $P = I^2R$
   for given resistance (of cables)
   cables heated by current   B3   [7]

3 **(a) (i)** <u>changing</u> magnetic field (in coil) **or** field lines cut coil (**or** *vice versa*)   B
      e.m.f./current induced   B1

    (ii) smaller deflection/current/reading/voltage **or** deflection lasts longer (ignore
       slower)   B1
       rate of cutting field lines/change of magnetic field reduced   B1

    (iii) deflection/current in opposite direction   B1

 (b) alternating/changing current (in primary coil)   B1
   alternating/changing magnetic field clearly in core   B1
   field channelled from primary to secondary by core (somehow
   expressed) **or** core increases effect   B1
   <u>induced</u> e.m.f. in secondary   B1   **[9]**

4 **(a** first finger – field / magnetism / flux   )
   second finger – current / charge flow (NOT electron flow)   ) both   B1

 (b)   brush OR contact OR <u>sliding</u> connector   B1
      split ring OR commutator NOT slip ring   B1

    (ii) clockwise OR right side down OR left side up OR correct arrows
       on figure   NOT turn to the right   B1

    (iii) more current / more voltage / "stronger battery" / more power   )
       more turns on coil / more coils   )
       stronger magnet Ignore bigger magnets   )
       closer magnet / magnetic poles   ) any 2 B1, B1
       more magnets   )
       iron core   )   [6]

5 **(a)** **(i)** circular line of force around wire through P   **M1**
                 arrow(s) on line anticlockwise - none wrong   **A1**
          (ii) arrow through Q to left   **A1**   **3**

       (b) **(i)** none/stays same   **B1**
          (ii) direction reverses   **B1**   **2**

       (c)   at S - stronger   **B1**
                 at T - same (strength)   **B1**
                 at W - same (strength)   **B1**   **3**
                                                 [8]

6 a(i) steel | A1
   (ii) insert bar in coil(switch on,leave,switch off) | B1
   (iii) to control/measure current or stop circuit/coil overheating | B1   3

b(i) R = 12/4   C1
    = 3 ohms*   2 A1
  (ii) P = 12 x 4   C1
    = 48 W*   2 A1
  (iii) E = 48 x 5   C1
    =240 J*   2 A1   6

c(I) 5 (V) | A1
  (ii) sum of p.d.'s = circuit supply p.d.   C1
    above + detail eg across each component/ in closed circuit etc   2 A1   3
                                                                 QT 12

7 a (magnetic field) from left to right/ N to S | B1   1

b(i) movement at right angles/between poles, up or down   C1
   (vertically)down,stated or reference to arrow on diagram or label   2 A1
  (ii) mention of Fleming's L.H.R. or interacting fields   C1
    full explanation leading to correct direction e.g what fingers show   2 A1   4

c use coil instead of single wire   B1
   mount coil on bearings   B1
   arrange suitable contacts e.g slip/slit rings and commutator   2 B1 M2
                                                                   QT 7