Cambridge International Examinations
Cambridge Ordinary Level

Cambridge O Level

PHYSICS **5054/22**

Paper 2 Theory **May/June 2016**

MARK SCHEME

Maximum Mark: 75

Published

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1 **(a)** mark at a time <u>between</u> 4.0 and 7.5 seconds   B1

    (b) $(a =) (v – u)/t$ numerical or algebraic   C1
        or $(a =)$ gradient of graph stated
        $2.5 \, \text{m}/\text{s}^2$ A1

    (c) forward force and backward force clear   B1
        equal forces (in horizontal direction)   B1
        or no resultant force
        or forces cancel / balance / in equilibrium

2 **(a)** $(PE =) mgh$ **or** Fd **or** 5×3.5 C1
        $17.5 \, \text{J}$ **or** $17 \, \text{J}$ **or** $18 \, \text{J}$ A1

    (b) **(i)** (efficiency = useful) energy output / energy input   B1
            in any form but all three quantities must be mentioned
            if efficiency is not the subject of the equation

        (ii) $17.5/0.65$ **or** $17.5/65$ C1
            or $0.65/65 = $ **(a)** / energy input
            $26.9 \, \text{J}$ **or** $27 \, \text{J}$ A1

    (c) due to friction (in bearings of motor)   B1
        or due to (electrical) resistance (in motor)
        or air resistance acts
        or thermal energy / heat produced / lost (in resistance of motor / due to friction)

3 **(a)** **(i)** **C**   M1

        (ii) **data** quoted to prove stretches more at end   A1
            or extensions / changes in length increase / are not the same (at higher loads)

        (iii) $4.5 \, \text{cm}$ B1

    (b) (tie rock to spring A)   B1
        • find weight / force / newtons using length or extension **and** graph **or** match
          readings (in table)
        • find <u>known</u> weight / mass / force / N that gives same extension of spring
        • use of proportionality with length or extension
        • extension (in cm) / 1.6
        (mass =) weight / g   B1
        or weight / gravitational field (strength)

4 (a) steam   **B1**
    or (water) vapour
    or water in gaseous form

  (b) $(E =) mL$ numerical or algebraic   **C1**
    or 52 000–6000 **or** 46 000 (J) seen

    (52 000–6000)/20 **or** 46 000/20   **C1**
    2300 J/g **or** 2.3×10^6 J/kg   **A1**

  (c) fast moving/energetic molecules escape/evaporate/break bonds/become gas   **B1**
    leaving slow(er) molecules/less energetic molecules   **B1**
    or reducing **average** (kinetic) energy (of molecules or liquid)

5 (a) (i) long-sight **or** far-sight **or** hypermetropia   **B1**

    (ii) rays do not come together (on back of eye)   **B1**
        or rays do not converge (on retina)
        or it/the image is not formed on retina/back of eye
        or it/the image is formed behind retina/back of eye

  (b) (i) lens between rays and eyeball **and** a converging lens shown   **B1**

    (ii) converging or convex   **B1**

6 (a) (i) red   **B1**

    (ii) blue   **B1**

  (b) ANY 2 from (the use must agree with the type)   **B4**

    Microwaves   **B1**
    use – satellite television, telephone, mobile/cell phones;   **B1**
    cooking, heating in a microwave oven, television
    remote, radar, communication

    X(-rays)   **B1**
    use – hospital use in medical imaging or security imaging, killing cancerous cells,   **B1**
    and engineering applications such as detecting cracks in metal, crystallography

    gamma (rays)   **B1**
    use – medical treatment in killing cancerous cells, and engineering applications   **B1**
    such as detecting cracks in metal, sterilisation, tracer applications, radiotherapy

7 (a) any insulator, e.g. perspex, plastic, nylon, rubber   **B1**

(b) top of P shows a net negative charge with some negative charges under rod   **B1**
bottom of P has equal number of positive charges   **B1**

(c) (i) clear net negative charge on P   **B1**
and (net) negative charges above or at middle line

     (ii) 1 negative (charges)/electrons flow to earth   **B1**
         or (P) <u>becomes</u> neutral

        2 charges spread over P   **B1**

8 (a) current/a.c (in primary coil) creates magnetic field   **B1**
or current/a.c magnetises iron
changing magnetic field (in secondary)   **B1**

(b) it/secondary has less turns (than primary)   **B1**
or primary has more turns (than secondary)
or (some) flux escapes

(c) (steel is) a permanent magnet   **B1**
or weaker fields produced
or (steel) difficult to magnetise/demagnetise
or (steel) is a hard magnetic material

(d) passes current/charge in one direction   **B1**
or has high resistance/is an insulator when current in
one direction/reverse biased

9 (a) (amount of) energy/work (dissipated by source)   **M1**
by unit charge (around a circuit)   **A1**

(b) (i) 1 they are the same   **B1**
         or $I_B = I_1 = I_2$

        2 $E = V_1 + V_2$ **B1**

     (ii) (I=) V/R in any form algebraic or numerical   **C1**
         0.25 A   **A1**

     (iii) 4.5 V   **B1**

     (iv) (P=) VI **or** (P=) I^2R **or** (P=) V^2/R **C1**
         in any form algebraic or numerical
         1.1(25) W   **A1**

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(c) current is (directly) proportional to voltage   B1
     or voltage / current is a constant
     law holds for constant physical conditions /   B1
     constant temperature / constant pressure / for metals

(d) (i) (directly) proportional   B1
         or $(R) \propto 1$

    (ii) inversely proportional   B1
         or $(R) \propto 1/A$

(e) 1st band orange   B1
     2nd and 3rd bands both black   B1

10 (a) (i) B – anode   B1
         D – filament **or** heater   B1
         E and F–Y plates or X plates in either order   B1

    (ii) 1   attract electrons **or** gives electrons speed / K.E.   B1

           2   heats up cathode   B1
                or gives electrons energy to escape (metal / cathode)
                or causes / allows thermionic emission

    (iii) kinetic energy to light   B1
        or electrical energy to light

    (iv) voltage/charge is applied to the X-plates / vertical plates   B1
        or turn on time base
        (steadily) increasing voltage / charge applied to plate(s)   B1
        or saw tooth voltage applied
        or electrons attracted / repelled by plate(s) or by the electric field between them

   (b) (i) 1 $1(.0)$ V   B1

           2   one wave 1.3–1.4 squares **or** 3 waves in 4 squares   C1
                2.6–2.8 ms   A1

           3 $(f =) 1/T$ numerical or algebraic   C1
                345–400 Hz   A1

    (ii) smaller amplitude shown   B1
        larger period shown   B1

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Page 6	Mark Scheme	Syllabus	Paper
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11 (a) (nucleus / nuclide / atom) with same number of protons   B1

    (b) (i) 2   B1

      (ii) neutron   B1

    (iii) 2   B1

    (iv) 4   B1

    (c) nuclei repel   B1
      or like / positive charges repel
      (needs) high <u>kinetic</u> energy / speed (to overcome repulsion)   B1

    (d) ANY 3 lines from   B3
      (dust / gas) collapses / comes together / clusters / condenses
      gravitational attraction or gravity mentioned   B1
      temperature <u>rises</u> or KE (dust / gas) increases   B1
      (nuclear) fusion occurs   B1
      equilibrium established as radiation pressure / outward
      force balances inward force   B1

    (e) (i) <u>time</u> for a quantity to halve   C1
      <u>time</u> for (radio)activity / count rate / number of atoms / number of nuclei to halve   A1

      (ii) any relevant halving seen, e.g. 16 000 / 2   C1
        1000   A1