Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary 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 between 4.0 and 7.5 seconds B1

(b) (a =) (v – u) / t numerical or algebraic C1
or (a =) gradient of graph stated
2.5 m / 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 J **or** 17 J **or** 18 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 J **or** 27 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 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 known 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

(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) ∝ 1

(ii) inversely proportional B1
or (R) ∝ 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 m s A1

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

(ii) smaller amplitude shown B1
larger period shown B1

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 kinetic 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 rises or KE (dust / gas) increases B1
(nuclear) fusion occurs B1
equilibrium established as radiation pressure / outward force balances inward force B1

(e) (i) time for a quantity to halve C1
time 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