CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2012 series

5054 PHYSICS

5054/21   Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

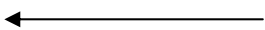Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

CAMBRIDGE
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Section A

1 (a) 950 N   B1
     upwards   B1

(b) correct rectangle **and** diagonal **and** at least one velocity labelled
     or correct triangle and at least one velocity labelled
     (either way round)   B1
     from 7.8(0000) to 8.0(0000) m / s (inclusive)   B1
     scale stated   B1   [5]

2 (a) (i) output/voltage/e.m.f. (directly) proportional to temperature (difference)   B1

     (ii) $\dfrac{7.70 - 6.20}{800 - 750}$ **or** 1.5/50 **or** 0.03 **or** 0.6/1.5 **or** 20(°C)   C1
           770 °C   A1

(b) glass melts/liquid boils/no remote reading (e.g. head in furnace)   B1   [4]

3 (a) (i) (WD =)mgh **or** 54 × 10 × 2.8   C1
           1500/1510/1512 J   A1

     (ii) (P =) WD/t **or** E/t **or** 1500/3 **or** 1510/3 **or** 1512/3   C1
           500/503/504 W   A1

(b) any **two** of:
     also lifting board/rope
     heat in motor/wires/cable
     friction with something named e.g. axle/spindle/air   B2

(c) (i) power supply, motor and ammeter in series
           (**ignore** series voltmeter and other components)   B1
           voltmeter to measure voltage across motor   B1

     (ii) current (reading) × voltage (reading) **or** VI B1   [9]

4 (a) (m=)ρV **or** 740 × 30 or 22 000/22 200   C1
     25 000/2.5 × 10⁴ kg (allow 24 800 from 22 000)   A1

(b) (a =)F/m **or** 30 000/25 000   C1
     (−)1.2 m/s²   A1   [4]

5 **(a) (i)** clear attempt at measuring more than one wavelength e.g. 6.85/5
         or 1.30 – 1.45 cm   B1
         10.7 – 11.3 cm   B1

      (ii) $(v =)f\lambda$ **or** 3.6 × **(a)(i)**   C1
          40(39.6) cm / s   A1

    (b) (i) stays the same   B1

      (ii) decreases   B1   [6]

6 **(a)** any **three** of:
     infra-red and microwaves reversed
     visible light is omitted
     ultrasound is not e.m./should not be included
     ultraviolet is missing ('ultrasound instead of light' scores 2)   B3

    (b) engineering use   M1   detail/explanation   A1

        detecting cracks in metal   (more) X-rays pass through
                                              crack/poor weld
        or   **or**
        checking welds   image of crack on film/screen
        astronomy   hot stars emit X-rays
        crystallography   diffraction reveals pattern of atoms
        fluorescence   substances re-emit different energies
        (airport/border) security   contents of luggage/lorries revealed
        paintings investigated   underpainting revealed

      (**not** medical use)   [5]

7 **(a)** (at least) **two** parallel horizontal lines within the cylinder   B1
     (at least) **two** correctly shaped lines outside the cylinder   B1

    (b) (i) ⟵——————— (right to left) **and** on diagram (somewhere)   B1

      (ii) **1.** path continuously curving in same direction   M1
           upwards (**ignore** lines outside the shaded area)   A1
        2. (changes to) downwards (curve) **not** reverses/opposite direction   B1   [6]

8 (a) (i) $(V =)IR$ or $0.025 × 600$ C1
         15 V   A1

    (ii) 5(V) **or** 5/0.025 **or** 800 **or** 800–600   C1
         200 Ω A1

  (b) (i) decreases   B1

    (ii) ammeter: opposite to **(i)**
         voltmeter: same as ammeter (both changes correct)   B1   [6]

                                                                                             [Total: 45]

Section B

9 (a) (i) $(\Delta P=)\rho gh$ **or** $1000 × 10 × 120$ C1
         $1.2 × 10^6$ Pa   A1

    (ii) $1.3 × 10^6$ Pa   B1   [3]

  (b) (i) $(F =)PA$ **or** $1.2 × 10^6 × 0.45$ **or** $1.3 × 10^6 × 0.45$ **or** $5.4 × 10^5$ (N)   C1
         $5.8/5.85/5.9 × 10^5$ N   A1

    (ii) any **two** of:
         weight of hatch
         pressure inside submarine
         friction at seal/hinge/water resistance
         lever effect   B2   [4]

  (c) (i) sound or pressure wave   B1
         frequency > 20 kHz/**frequency** beyond human hearing/inaudible   B1

    (ii) (water) molecules/particles vibrate/oscillate   B1
         molecules collide with other molecules/neighbours   B1
         pass on vibration/energy (to neighbours)
         or longitudinal (vibration/wave) or compressions and rarefactions   B1

    (iii) **1.** speed of sound/ultrasound (in water/sea water)   B1
         2. speed × t ÷ 2   B1

    (iv) cleaning/quality control/detecting cracks/prenatal screening/
         kidney stones/detecting shoals of fish/(used by dolphins/bats)   B1   [8]

                                                                                            [Total: 15]

10 (a) 16 × 7.5 **or** 120 **or** 96–17 **or** 79   C1
   $(Q =)mc\Delta T$ **or** 120 × 2300 × 79   C1
   2.2(2.1804) × 10^7 J   A1 [3]

(b) (i) 2.2 × 10^7/7 **or** 2.2 × 10^7/ (7 × 60) **or** 2.2 × 10^7/ (7 × 3600) C1
    3.1 × 10^6 J / h **or** 5.2 × 10^4 J / min **or** 870 J / s **or** W A1

  (ii) (heater/bricks) hot(ter) (**not** room cooler)   B1
     great(er) temperature difference (between heater and room) B1 [4]

(c) air (next to heater) gets hot or conduction through metal/casing B1
   expands or radiation or IR (radiation)   B1
   less dense   B1
   rises   B1
   circulation or convection current or arrows on Fig. 10.2 B1 [5]

(d) double glazing/cavity walls/ceiling
  tiles/carpet/curtains/loft insulation etc. **or** shiny foil   B1
  traps air   radiation reflected M1
  air is poor conductor/convection   IR radiation/
  prevented   back into room A1 [3]

                      [Total: 15]

11 (a) (i) correct negative charges on tree.   B1

  (ii) electrons/-ve charges attracted by cloud/+ve charges B1
     electrons from ground or correct induction mentioned B1

  (iii) 1. 560/1.6 × 10^{-19} C1
      3.5 × 10^{21} A1

    2. $(I =)Q/t$ or 560/2 × 10^{-4} C1
      2.8 × 10^6 A   A1 [7]

 (b) (i) at least 4 vertical lines between plates   B1
     equally spaced or curved at edges   B1
     arrows +ve to –ve/upwards   B1

  (ii) oil droplet positively charged   B1
     attraction/force on (droplet) and in direction of field/upwards B1
     force greater than weight (of droplet) or resultant force B1

  (iii) (droplet becomes) negative   C1
     (droplet) gains electrons   A1 [8]

                      [Total: 15]