UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2011 question paper

for the guidance of teachers

5054 PHYSICS

5054/22 Paper 2 (Theory), maximum raw mark 75

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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5054	22

Section A

1 **(a)** $m_1(g)x_1$ **or** $m_2(g)x_2$ **or** 2 **or** one of these in numbers **or** 40 **and** 25 seen   C1
$0.050 \times (10) \times 40 = m_2 \times (10) \times 25$
or anticlockwise **moment =** clockwise **moment**   C1
$0.080\,$kg **or** $80\,$g   A1

    (b) $(\rho/d =)\ m/V$ **or** $0.08/1.6 \times 10^{-4}$ C1
$500\,$kg$/$m^3 **or** $0.50\,$g$/$cm^3 A1   [5]

2 **(a)** **(i)** $850\,$N   B1

       (ii) KE = PE$/mgh$ **or** $mgh = 5.5 \times 10^4$ C1
$65/64.7(0588)\,$m   A1

    (b) WD = Fx **or** KE$/x$ **or** $5.5 \times 10^4/33$ **or** $v = 35(.97)$ **and** $a = 19(.60)$ **and** $F = ma$ C1
$1700/1670/1667/1666.7\,$N   A1   [5]

3 **(a)** **(i)** $p_1V_1 = p_2V_2$ B1

       (ii) $2.5 \times 10^7 \times 18 = 1.0 \times 10^5 \times V_2$ C1
$4500\,$m^3 A1

    (b) balloon inflates higher up/bursts (if fully inflated on ground)   B1
(atmospheric) pressure is less higher up/decreases with height   B1
OR
(otherwise) greater upthrust/upwards force   B1
(otherwise) rises (too) high/fast   B1   [5]

4 **(a)** $3(.00) \times 10^8\,$m$/$s   B1

    (b) $0.16\,$m **or** $16\,$cm   B1

    (c) any **three** of:
travel through space/vacuum
pass through the atmosphere/not reflected by ionosphere
encoded (with the signal)
(satellite) amplifies/boosts signal
sent to/received by satellite
transmitted/sent by satellite
transmitted/received by a (satellite) **dish** (on Earth)   B3

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Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5054	22

(d) any **two** of:
same (high) speed (in air) **or** travel at speed of light
travel in vacuum/space **or** no medium needed
transfer/transmit energy
transverse (stated **or** explained)
(oscillating) magnetic **and** electric fields/waves
reflection/refraction/diffraction/interference/polarisation   B2   [7]

5   **(a)**   **(i)**   N at top end of bar **and** S at bottom end   B1

       (ii)   attracted to/moves towards iron core   B1
             unlike poles attract   B1

   (b)   they disappear/bar is demagnetised/loses its poles/is weaker   B1   [4]

6   **(a)**   **(i)**   power supply, (wire/resistor/bulb) and ammeter in series   B1
             voltmeter across wire/resistor/bulb **labelled/clear**   B1
             variable power supply **or** rheostat in series **or** potentiometer   B1
             correct symbols **or** labelled throughout

       (ii)   read ammeter **and** voltmeter / measure voltage **and** current   B1
             vary power supply/rheostat/current   B1

       (iii)   ($R =$) V/I (**ign.** V/A)   B1

   (b)   horizontal line **and** above axis   B1   [7]

7   **(a)**   ($P =$) VI **or** 23 000 × 65   C1
           1.49/1.5/1.50/1.495 × 10^6 W   A1

   (b)   **(i)**   ($V =$) IR **or** 65 × 3   C1
             190/195/200 V   A1

       (ii)   1.3(1.27 etc.) × 10^4 J   B1

   (c)   **(i)**   low current/less energy/power wasted/less heat generated/less voltage **loss**/
             more efficient/thinner wires   B1

       (ii)   **step-down** transformer between them **or** less insulation needed **or** less
             dangerous **or** less chance of electric shock **or** less danger of sparking /fire   B1   [7]

8   **(a)**   **(i)**   central ray undeviated emerging from lens   M1
             two outer rays meet the central ray at a point inside the eye **and** carry
             on to strike the retina   A1

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Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5054	22

(ii) light (from a single point) is spread over an area (on the retina)
or rays do not meet at a point on the retina
or image formed/rays meet/principal focus off retina   B1

(b) (i) **any** diverging lens: biconcave, planoconcave, convexoconcave –
i.e. lens **clearly** thinner at the centre   B1

(ii) **all** rays diverge   B1   [5]

Section B

9 (a) 72 m/s   B1

(b) (i) area (under graph) **or** ½ base × height **or** ½vt **or** ½ × 9 × 72   C1
320/324 m   A1

(ii) **change** in velocity/time **or** $\Delta v/t$ **or** 72/9   C1
8(.0) m/s^2 A1

(iii) (F =) ma **or** 650 × 8.0   C1
5.2 × 10^3 N   A1

(c) friction **or** air/wind resistance **or** drag   M1
increases as speed increases   A1
resultant/net/unbalanced force remains constant   B1

(d) (i) **direction** (of car/motion/speed/velocity) changes   B1
(therefore) velocity changes   B1

(ii) towards centre (of circle)/centripetal   B1

(iii) friction **with ground**   **OR**   banking of track   B1
mention wheels/tyres   reaction force (acts towards centre)   B1   [15]

10 (a) **temperature** where: liquid and solid may exist together **or** solid turns to liquid   B1

(b) (i) (E =) ml C1
0.0019 × 2.2 × 10^4 **or** 1.9 × 2.2 × 10^4 **or** 41 800 **or** 42 000   C1
42 (41.8) J   A1

(ii) ½mv^2 **or** ½ × 0.0019 × v^2 **or** ½ × 1.9 × v^2 C1
(v^2 =) 44 000 **or** 44   C1
210 (209.761 etc.) m/s   A1

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Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5054	22

    (iii) any **two** of:
        heat lost to wall
        heat to raise bullet to m.p.
        air resistance/**air friction** reduces energy/speed/velocity **or** work done
        against **air resistance**/**air friction** (in air/as bullet travels)   B2

(c) any **three** of:
    molecules become further apart
    molecules become randomly positioned/less ordered
    molecules moving throughout liquid/in clusters/were fixed/free to move/
    slide over each other
    bonds broken/overcome/weaker **or** forces reduced   B3

(d) twice the energy needed   **OR** $ml = \frac{1}{2}mv^2$ M1
    (bullets have) twice the KE m cancels **or** mass irrelevant **or** w.t.t.e.
                              or calculation   M1
    they melt   A1   [15]

11 (a) (nuclear) fission   B1

    (b) (i) 1...143   B1
            2...36   B1
            3...141   B1

      (ii) $(E =) mc^2$ C1
          $3.1 \times 10^{-28} \times (3.0 \times 10^8)^2$ **or** $3.1 \times 10^{-28} \times 3.0 \times 10^8$ **and** $(E =) mc^2$ C1
          $2.8(2.79) \times 10^{-11}$ J   A1

    (c) any **five** of:

core/rods/ reactor/^{235}U	→	**coolant**	→	boiler/ water

    (**one** mark for three correct boxes)

    (splitting produces) kinetic energy of neutrons
    further splitting/chain reaction
    energy/heat produced/from reactor/reaction **or** from neutrons
    coolant gets hot
    energy to boiler/water **or** water heated **or** heat in water implied
    water boiled **or** steam produced   B5

    (d) (i) **time** for something to halve   C1
            time for (radio)activity/count rate/number of atoms/nuclei to halve   A1

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE O LEVEL – October/November 2011	5054	22

(ii) **one** appropriate precaution:
short exposure time
safety/protective suit/gloves/clothes **or** lead boxes
large distance/(long handled) tool/forceps/tongs
robotic/mechanical handling
film badge   B1   [15]