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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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) × 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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(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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(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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(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

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(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]

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