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

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.

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UNIVERSITY of CAMBRIDGE
International Examinations

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

(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

(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

(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

(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]