

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
 $65/64.7(0588) \text{ m}$ 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
 $1700/1670/1667/1666.7 \text{ N}$ 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) $3(.00) \times 10^8 \text{ m/s}$ 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** $23\,000 \times 65$ C1
 $1.49/1.5/1.50/1.495 \times 10^6 \text{ W}$ A1
- (b) (i) $(V =) IR$ **or** 65×3 C1
 $190/195/200 \text{ V}$ A1
- (ii) $1.3(1.27 \text{ etc.}) \times 10^4 \text{ J}$ 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 $\frac{1}{2}$ base $\times$ height or $\frac{1}{2}vt$ or $\frac{1}{2} \times 9 \times 72$ C1
 320/324 m A1

- (ii) **change** in velocity/time or $\Delta v/t$ or 72/9 C1
 8(0) m/s² 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
 $0.0019 \times 2.2 \times 10^4$ or $1.9 \times 2.2 \times 10^4$ or 41 800 or 42 000 C1
 42 (41.8) J A1

- (ii) $\frac{1}{2}mv^2$ or $\frac{1}{2} \times 0.0019 \times v^2$ or $\frac{1}{2} \times 1.9 \times v^2$ 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. M1
or calculation A1
 they melt [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
 $2.8(2.79) \times 10^{-11} \text{ J}$ A1

- (c) any **five** of:



(**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]