UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

5054 PHYSICS

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

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Section A

1 (a) (i) straight line continues to 6 ± 0.2 s B1

(ii) 3(.0) s OR the time on Fig. 1.1 when $v = 0$ B1

(b) (a =) ($v - u$)/t in any form numerical or algebraic C1
(–)1.6 m / s^2 A1

(c) any TWO lines:
(at first) graph steeper/higher acceleration/deceleration
caught sooner/shorter time to maximum
graph curves (due to air resistance) B2 [6]

2 (a) (K.E.) = ½ mv^2; ½ × 90 × 5^2 C1
1125 J **or** 1100 J A1

(b) (i) no resistant force; forwards force = backwards force/drag/friction (ignore air resistance) B1
water resistance/**water** drag mentioned/**water** friction OR sail exerts force on board B1

(ii) heat produced OR equal to work done against backwards force/drag/friction B1 [5]

3 (a) 14 N B1

(b) (P =) F/A algebraically in symbols or words in any form; 14/3.0 × 10^{-5} C1
4.67 × 10^5 Pa; 4.7 × 10^5 Pa ecf **(a)** A1

(c) stiffer/stronger spring; piston has less area/diameter; smaller piston (and tube) B1

(d) molecules/particles/atoms collide with tyre/walls/piston B1
air/molecules enter gauge; fewer molecules in the tyre; fewer hits/sec;
less frequent hits; volume increases B1 [6]

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4 **(a)** **temperature** when solid melts;
temperature when solid changes to liquid B1

(b) **(i)** temperature increases; molecules move faster/have more kinetic energy/ vibrate faster/move further apart B1

(ii) change of state; solid changes to liquid B1
latent heat provided; break bonds; molecules move apart/break free;
reduce bond strength; idea of more disorder B1

(c) liquids expand more than solids B1 [5]

5 **(a)** **(i)** X-ray(s) B1

(ii) infra-red B1

(b) any TWO lines:
same speed (in vacuo)
travel in a vacuum; need no medium
carry energy
transverse
can reflect/refract/diffract/interfere/polarise B2

(c) microwaves B1 [5]

6 **(a)** **(i)** amplitude decreases B1

(ii) constant frequency/time for one wave/wavelength/period B1

(b) **(i)** number of (complete) cycles in one second B1

(ii) (f =) 1/T in any form numerical or algebraic; 1/0.02 C1
50 Hz A1

(iii) 0.06 s B1 [6]

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7	**(a)**		LED; light-emitting diode	B1	
	(b)		energy/work done per unit charge/coulomb	B1	
	(c)		voltage/p.d. across P	B1	
			one cell connected the wrong way/acting against the others	B1	
	(d)	**(i)**	correct arrangement	B1	
		(ii)	cells last longer; cells run down slower; one cells fails the others still work; reduces (internal) resistance; if cell removed circuit not broken	B1	[6]
8	**(a)**	**(i)**	iron; soft iron; mu-metal	B1	
		(ii)	rod becomes (an induced) magnet	B1	
			opposite poles attract; N attracts S OR magnetic pole(s) on rod/at P reverses (due to induced magnetism)	B1	
	(b)	**(i)**	at least two circles centred on wire (no crossings)	B1	
			clockwise arrow on at least one circle and no arrows wrong	B1	
		(ii)	lines closer together	B1	[6]

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Section B

9	**(a)**	**(i)**	fuse symbol correct	B1	
			in live wire before junction of two elements	B1	
		(ii)	the (metal) case/outside	B1	
		(iii)	**1.** live wire touches case; live touches person	B1	
			2. current goes to earth; current does not go through the person	B1	
			fuse blows	B1	
	(b)	**(i)**	most of the energy output is useful/heat; little energy is wasted;	B1	
		(ii)	hot air rises (**not** heat rises)	B1	
			density of hot air is lower	B1	
			convection current mentioned OR hot air rises and cold air falls	B1	
	(c)	**(i)**	1500 W	B1	
		(ii)	**1.** conversion to kW seen on any power; 2.1 (kW) seen	C1	
			5.25; 5.2; 5.3 (kW h)	A1	
			2. $E = P \times t$ in any form, algebraic or using any power or time e.g. 600 × 2.5, 600 × 150	C1	
			1.89×10^7 (J) OR 3.6×10^6 × **(c)(ii)1.**	A1	[15]

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10 (a) (i) refraction B1

(ii) (n =) sin i/sin r C1
sin 45°/sin 29° C1
1.4585 to more than 1 sig. fig. A1

(iii) the angle of incidence/incident angle is greater than the critical angle B1
total internal reflection occurs B1

(iv) correct refraction at C with ray parallel to AB B1
correct reflection (and correct refraction on other face i.e. downwards) B1

(b) (i) Any TWO of:
undeviated ray through centre of lens
ray parallel to axis through point 3 cm from lens on right after lens
ray through point 3 cm to left of lens parallel to axis after lens M2
rays converge and vertical image drawn and labelled I A1

(ii) 1.2 ± 0.2 cm B1

(iii) **1.** real image (can be) formed on screen; virtual image not found on screen;
rays converge on real image; rays do not converge on virtual image;
rays only appear/seem to come from a point on virtual image B1

2. place object within focal length; between lens and focal point/principal focus B1
view from other side of lens; look through lens; image same side as/behind object B1 [15]

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11 (a) (gamma) produces little or no ionisation; passes out of detector; requires shielding; reaches people B1

(b) (i) at least 3 lines between plates and in middle at least one **straight**, **vertical** line B1
correct curvature at edges B1
at least one arrow down and no arrows wrong B1

(ii) alpha charged (positively); alpha repelled by positive/attracted by negative B1
deflected down/towards positive (plate) B1

(c) (gamma) undeviated; straight line B1
(gamma) uncharged B1

(d) (i) any attempt at halving or 3 **half-lives** seen C1
1/8; 0.125; 12.5% A1

(ii) decays too fast; have to replace source often; current falls too quickly; detector only works for a short time B1

(iii) 1. any TWO of:
number of protons
number of electrons
charge on nucleus B2

2. number of neutrons B1
nucleon or mass number or mass B1 [15]

(americium-242 has **one** extra neutron gets 2 marks)

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