

**MARK SCHEME for the May/June 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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


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### Section A

- 1 (a) (uses spring balance) for a reading/value // finds weight/force of gravity  
divides reading/weight by 10/g // uses  $W = mg$  B1  
B1
- (b) reading (of measuring cylinder) taken with liquid/water (alone) //  
initial volume mentioned // fill to certain level C1  
measure increase/change when stone (totally) immersed/in cylinder A1
- (c) 2.1 or 2.14 g/cm<sup>3</sup> // 2142.86 kg/m<sup>3</sup> // 0.00214286 kg/cm<sup>3</sup> B1
- (d) mass unchanged **and** weight less B1 [6]
- 2 (a) chemical (potential) energy at start B1  
gravitational/potential energy increases B1  
thermal energy/heat/internal energy produced B1
- (b) energy not created/lost/destroyed // energy **only** changes form // total energy  
constant **and** at least one attempt to explain a conversion **in the journey** // all  
ends up as heat B1
- (c) ( $h =$ ) PE/mg numerical or algebraic seen, e.g. 5400/10 × 60 C1  
9(.0) m A1 [6]
- 3 (a) (i) molecules have more **kinetic** energy/speed/velocity B1  
hit sides hard(er)/with more force // (initially) hit sides (more) often/frequently B1  
// create large(r) pressure (initially) B1
- (ii) (larger) forces between liquid molecules/(stronger) bonds B1
- (b) (i)  $P_1V_1 = P_2V_2$  numerical or algebraic C1  
6(.0) cm<sup>3</sup> A1
- (ii) temperature is constant // no gas enters/leaves // mass constant B1 [6]

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- 4 (a) 2(.0) mm B1
- (b) same period (by eye), with at least one wave opposite phase to wave drawn B1  
B1
- (c) (i) ( $f =$ )  $1/T$  numerical or algebraic seen (e.g.  $1/0.5$ ) // 1 wave in 0.5 s // 2 waves in 1 s C1  
2(.0) Hz A1
- (ii)  $v = f\lambda$  //  $8 \times 2$  or  $8 \times$  (i) // 16 (cm/s) // 5 (wavelengths from centre to edge) // ( $t =$ )  $d/v$  C1  
2.5 s **ecf** from (i) – i.e. **accept 5/(c)(i)** A1 [7]
- 5 (a) ammeter in series with supply // ammeters in series with A **and** in series with B & C B1  
A across cell with no switch (condone closed switch) **not**  B1  
B and C in series with switch (closed or open) and cell B1
- (b) (i) ( $R =$ )  $V/I$  in any form numerical or algebraic, e.g.  $8/50$ ,  $8/0.05$  C1  
 $160 \Omega$  A1
- (ii) 50 mA // 0.05(0) A B1 [6]
- 6 (a) no shock // no electrocution B1  
(if) case becomes live // live touches case B1
- (b) correct conversion to kW, 0.5 seen // conversion to hours //  $0.75$  //  $\frac{45}{60}$  // ( $E =$ )  $P \times t$  C1  
 $0.375$  //  $0.38$  //  $0.37$  (kW h) A1 [4]
- 7 (a) (same) electrons/beam produced/emitted by heating // thermionic emission occurs B1  
still produces heating // same heating // heating depends on  $I^2$  B1
- (b) no beam produced // electrons do not reach screen/do not pass anode/not emitted B1  
electrons/beam repelled by negative/anode // electrons no longer attracted by anode // electrons/beam attracted by positive/filament B1 [4]

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- 8 (a) fission cao B1
- (b) neutron hits/goes inside (U) **nucleus** B1  
atom/nucleus/particle/uranium/nuclide splits/forms daughter nuclei **and** emits  
neutrons/energy B1
- (c) (i) emits particles // emits **ionising/nuclear** radiation // spontaneous or random  
emission (of radiation) // **atom/nucleus** decays B1
- (ii) long time to decay // radioactive for a long time // decays slowly  
long time for any quantity to halve B1  
halving of:  
count, count rate, emissions, (number of) **nuclei**, (number of) atoms, activity B1 [6]

### Section B

- 9 (a) (i) curve with decreasing gradient from origin to 50 m/s at 10 s B1  
constant speed from 10 to 20 s B1  
decrease to 5 m/s at 25 s B1  
constant speed from 25 s until at least 30 s B1
- (ii) gradient/slope not constant/decreases // graph curves // graph not a (straight)  
line // increase (in speed) per second/unit time not equal B1
- (b) any mention of **air** resistance/drag/upward force B1  
(initially) force upwards larger than force downwards // resultant force upwards B1  
air resistance decreases (with fall in speed) B1  
(at constant speed) air resistance/friction/drag equals weight //  
forces (up and down) balance // zero resultant force B1
- (c) 500 m B1
- (d) (i)  $(a =) \frac{v - u}{t}$  in any numerical or algebraic form, e.g. 45/5 C1  
9(.0) m/s<sup>2</sup> ecf (a)(i) A1
- (ii)  $(F = ma)$  in any numerical or algebraic form, e.g. 60 × 9 ecf (i) C1  
540 N A1
- (iii) area **under** graph/line/curve B1 [15]

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10 (a)	suitable block (semicircular/rectangular/prism)	B1	
	suitable source of rays (e.g. ray box; pins on incident ray; laser <b>not</b> torch)		
	<b>must</b> be labelled on diagram or clear in text	B1	
	diagram showing incident ray in glass/perspex (no arrow needed)		
	<b>and</b> correct refraction out into air	B1	
	adjustment of (angle of incidence of) ray until along surface/just no longer emerges	B1	
	(measure) correct angle marked or described clearly or C marked on diagram	B1	
(b) (i)	converging or convex	B1	
	(ii) ray from top through middle of lens undeviated	B1	
	other ray from top of object to same position on film	M1	
	correct image labelled/drawn/marked	A1	
	(iii) ratio of size/height/length/distance of image to size/height/length/distance of object	B1	
	(iv) 0.4(0) ( $\pm 0.05$ ) no ecf (iii)	B1	
	(v) upside down // inverted // real // other side of lens to object // nearer lens than object	B1	
	(vi) (otherwise) not focussed // to/adjust focus // to produce a clear/sharp image //	B1	
	(otherwise) rays do not converge on film // to converge rays onto film //		
	image on film // object at different distance	C1	
	(otherwise) image formed in front of film // object now further	A1	[15]
11 (a) (i)	50°C and 24/25°C	B1	
	(ii) heat loss or evaporation mentioned // molecules escape // liquid to vapour	C1	
	<b>more</b> heat loss or <b>more</b> evaporation etc. <b>because</b> temperature is higher	A1	
	(iii) temperature becomes 100°C // reaches boiling point // temperature becomes steady	B1	
	water boils // water turns to steam/gas // energy loss = energy gain	B1	
(b) (i)	( $c =$ ) $E/m\Delta T$ in any form, numerical or algebraic, e.g. $7400/72 \times 23$	C1	
	4.5 or 4.47 or 4.4686 J/(g °C) // 4468.6 J/(kg °C)	A1	
	(ii) ( $E =$ ) $\frac{1}{2} mv^2$ algebraic only	C1	
	$\frac{1}{2} \cdot 0.072 \cdot 450^2$	C1	
	7300 J // 7290 J (7 290 000 (J) alone gets 2/3)	A1	
	(iii) <i>water molecules</i> move/vibrate fast(er)/(more) vigorously	B1	
	<i>water molecules</i> <b>random</b> motion // move (more) throughout liquid/all directions // slide over each other // move in convection		
	// hit more often // move further apart	B1	
	<i>bullet molecules</i> motion in one direction/away from gun/towards target/		
	all have same (increase in) speed	B1	
(c)	two different metals at any junction/two outside wires if three used	B1	
	joined wires connected to meter/voltmeter/ammeter/galvanometer	B1	[15]