

MARK SCHEME for the May/June 2013 series

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus	Paper
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Section A

- 1 (a) travels further in each second / in same time / between images B1
- (b) $(s=) d/t$ in any form algebraic or numerical C1
40 cm/s; 0.4(0) m/s A1
- (c) air resistance increases B1
weight constant B1
- (d) forces balance /cancel B1 [6]
or no resultant/net force
or resultant of any two forces equal and opposite to third
- 2 (a) force \times distance M1
perpendicular distance A1
- (b) (i) $T \times 8$ or 2000×2 seen C1
500 N A1
- (ii) (two forces) equal (in magnitude) B1
(two forces) opposite (in direction) B1 [6]
- 3 (a) (i) $(W=) Fd$ C1
or 90×0.3
or 90×30

27 J A1
- (ii) $(P=) W/t$ C1
or Fd/t
or $27(\times 20)/60$
or $27/3$

9(.0) W A1
- (b) (i) $800 \times 30/180$ C1
or $800/6$
or 6 seen
or proportionality clearly used

133 or 130 cm A1
- (ii) extension more than 143 cm or (extra) extension > 10 cm B1 [7]
or (some) extension permanent

Page 3	Mark Scheme	Syllabus	Paper
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- 4 (a) gamma rays, visible light, infra-red B1
- (b) (i) microwaves B1
- (ii) satellite (receives and) sends/transmits/emits/boosts/amplifies signal B1
- (iii) cover a large area over the horizon / only one (transmitter/station) needed etc. B1 [4]
 or unaffected by tall buildings/hills
 or no obstructions
- 5 (a) electrons move onto polythene / rod B1
- electrons/negative charge move off cloth B1
- (b) (region of space) where force is exerted on a charge B1
- (c) (i) unlike charges attract B1
 or (rod) attracts +ve charge/ions/particles
- repels like charge B1
 or (rod) repels –ve charge/ions/electrons/particles
- (ii) (net) positive charge on water near rod B1 [6]
- 6 (a) (i) 2 to 2.1 (V) to any value between 11 and 12 (V) B1
 or above 2/2.1(V)
- (ii) temperature increases / gets hotter B1
- (b) (i) (rate of) flow of charge/electrons B1
- (ii) 0.35 A cao B1
- (iii) $(I=) V/R$ algebraic C1
 or $6/20$
 or $6/0.35$
- 0.3(0) (A) C1
 or $1/R_T = 1/20 + 1/17.1$
 or $(R_T =) 9.2 (\Omega)$ seen
- 0.65 A A1 [7]

Page 4	Mark Scheme	Syllabus	Paper
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- 7 (a) oval/circle through or near A centered on or near X
clockwise arrow on line(s) around X **and** none wrong B1
B1
- (b) fields (due to X and Y) cancel **or** X and Y fields equal and opposite B1
- (c) (i) to the left
or towards X/A/B B1
- (ii) current (in wire Y) and (magnetic) field (caused by other wire)
or two (magnetic) fields interact B1 [5]

8 EITHER

- (a) steel / magnadur / alnico / magnetite B1
- (b) (i) mention of cutting (lines of) magnetic field / change in (magnetic) flux M1
great(est) rate of change A1
or fast(est) cutting
or other explanation involving time
- (ii) vertical/upright B1
or turned through 90°
or normal to (magnetic) field

OR

- (a) NOT (gate)
or inverter B1
- (b) 1,0 B1
- (c) (i) (voltage across R_1) becomes 0/low B1
- (ii) decrease any of R_1, R_2, C_1, C_2 B1 [4]

[Total: 45]

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Section B

- 9 (a) (air) molecules hit walls / liquid (surface) B1
- (air) molecules move fast(er) /great(er) kinetic energy B1
- (air) molecules hit more often/more frequently/greater rate / harder / more force B1 [3]
or (liquid) molecules evaporate
- (b) (i) (flask) in (pure) melting ice (and water) B1
- (flask) in (pure) boiling water / above boiling water (at one atmosphere) B1
- (ii) thin(ner) tube
or large(r) flask
or more air/less liquid
or use liquid that expands more (1 mark for each) B2
- (iii) divisions not equally spaced **or** scale not uniform/not proportional C1
- different distance (along scale) for same temperature rise A1 [6]
or different change in temperature for same distance (along scale)
- (c) (i) $(M=) d \times V$ in any form **or** $1200 \times 5 \times 10^{-5} \times 0.15$ C1
- $9(.0) \times 10^{-3}$ kg; 0.009(0)kg A1
- (ii) 0.09(0) N ecf (i) B1
- (iii) $(P=) hdg$ in any form C1
or $(P=) F/A$ in any form
- 1800 Pa A1 [5]
- (d) liquids expand less (than air) B1 [1]
or great(er) forces between liquid molecules
- [Total: 15]**
- 10 (a) correct normal by eye B1
correct angle of incidence between candidate's normal and incident ray B1
correct angle of refraction marked between candidate's normal and BC B1 [3]
- (b) decrease / change in speed / wavelength B1 [1]

Page 6	Mark Scheme	Syllabus	Paper
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(c)	$n = \sin i / \sin r$ seen in any form	C1	
	($\sin r =$) $\sin 45^\circ / 1.5$ or 0.47(14) seen	C1	
	28(.1)°	C1	[3]
(d)	refracts less at first face and on correct side of normal	B1	
	refraction at second face away from normal so that red ray and blue ray are diverging	B1	[2]
(e)	(i) angle of incidence is 0 or ray along normal/perpendicular to glass	B1	
	(ii) angle of incidence/ θ is larger than critical angle total internal reflection occurs	B1 B1	
	(iii) reflected ray drawn correctly and emerging without refraction from block	B1	
	(iv) (eventually) light emerges (into air at Q) or light refracts (out at Q) or (weak) refracted ray appears	B1	
	light emerging at Q coloured in some way or correct description of movement of reflected ray (as θ decreases)	B1	[6]
			[Total: 15]
11	(a) power supply with ammeter and heater in series voltmeter in parallel with heater/ power supply	B1 B1	[2]
	(b) (i) ($P =$) VI in any form or 4.2×12	C1	
	50(.4) W	A1	
	(ii) ($E =$) Pt i.e. any power \times any time e.g. $50(.4) \times 8$	C1	
	8/60 or 0.13(3) seen or division by 1000 seen anywhere	C1	
	0.0067(2) (kWh)	A1	[5]

Page 7	Mark Scheme	Syllabus	Paper
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- (c) (i) molecules escape (from surface/leave water) / become gas or vapour / break bonds C1
- fast(er) moving / high energy/ energetic molecules escape A1

(ii)

change	M1	explanation	A1
wind / draught / breeze		wind knocks molecules away	
or larger surface area		more chance/possibility of escape/more space to escape or more molecules come to/near/at surface	
or decrease humidity / drier air		fewer molecules return/from air	
or decrease atmospheric pressure		fewer air molecules to hit during escape	

- (iii) evaporation occurs at surface **and** boiling inside liquid/bubbles
 evaporation occurs at any temperature (accept room temperature)
and boiling occurs at boiling point/100°C/ fixed / specific temperature
 evaporation increased by draughts/higher temp/more area **and** boiling is not
OR increase in pressure stops boiling but only reduces evaporation
 any two B2 [6]

- (d) water heats air (by conduction) B1
or water loses heat/energy (to cup or air)
or air gains heat/energy (from water)

- hot / heated air / particles rise B1 [2]
or cold air / particles sink
or hot air is less dense
or cold air is more dense

[Total: 15]