CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

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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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 **or** no resultant/net force **or** resultant of any two forces equal and opposite to third	B1	[6]
2	**(a)**	force × 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 **or** 90×0.3 **or** 90×30	C1	
		27 J	A1	
	(ii)	(P=) W/t **or** Fd/t **or** 27(× 20)/60 **or** 27/3	C1	
		9(.0) W	A1	
	(b) **(i)**	$800 \times 30/180$ **or** 800/6 **or** 6 seen **or** proportionality clearly used	C1	
		133 **or** 130 cm	A1	
	(ii)	extension more than 143 cm **or** (extra) extension > 10 cm **or** (some) extension permanent	B1	[7]

4 **(a)** gamma rays, visible light, infra-red

(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)** <u>electrons</u> move onto polythene / rod B1

<u>electrons/negative charge</u> 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 (Ω) seen

0.65 A A1 [7]

7 **(a)** oval/circle through or near A centered on or near X
clockwise arrow on line(s) around X **and** none wrong — B

(b) field**s** (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
or fast(est) cutting
or other explanation involving time — A1

(ii) vertical/upright
or turned through 90°
or normal to (magnetic) field — B1

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]

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]

(c) n = sin i/sin r seen in any form

(sin r =) sin 45°/1.5 C1
or 0.47(14) seen

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 B1
or ray along normal/perpendicular to glass

(ii) angle of incidence/θ is larger than critical angle B1
total internal reflection occurs B1

(iii) reflected ray drawn correctly **and** emerging without refraction from block B1

(iv) (eventually) light emerges (into air at Q) B1
or light refracts (out at Q)
or (weak) refracted ray appears

light emerging at Q coloured in some way B1 [6]
or correct description of movement of reflected ray (as θ decreases)

[Total: 15]

11 **(a)** power supply with ammeter and heater in series B1
voltmeter in parallel with heater/ power supply B1 [2]

(b) **(i)** (P=)VI in any form C1
or 4.2 × 12

50(.4) W A1

(ii) (E=) Pt i.e. any power × any time e.g. 50(.4) × 8 C1

8/60 C1
or 0.13(3) seen
or division by 1000 seen anywhere

0.0067(2) (kWh) A1 [5]

(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]