CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the May/June 2015 series

5054 PHYSICS

5054/21 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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1	(a)	(i)	60 m	B1
		(ii)	12 s	B1
	(b)	(i)	straight line from origin to 200 m at 40 s any line straight or curved from (40,200) to (60,500)	B1 B1
		(ii)	$s = d / t$ or 500 / 60 8.3 m / s	C1 A1
2	(a)	(i)	force moves through a distance (in same direction)	B1
		(ii)	chemical (potential) energy	B1
	(b)	(i)	480 Nm	B1
		(ii)	attempt to apply moments with two forces and distances 400 N	C1 A1
3	(a)		Pa **or** N / m^2 **or** cm of mercury **or** atmosphere(s)	B1
	(b)		correct points plotted at ($0.5V_0$, $2P_0$) and ($2V_0$, $0.5P_0$) curve through points of decreasing gradient	B1 B1
	(c)		molecules hit sides / piston	B1
			more molecules hit per second / hit more frequently molecular impacts create large(r) **force** (upwards on piston)	B1 B1
4	(a)		oscillate / vibrate stated or described transverse movement described	B1 B1
	(b)		0.40 m	B1
	(c)	(i)	$v = f\lambda$ or (f =) v / λ or 2 / (b) 5.0 Hz	C1 A1
		(ii)	clear attempt to draw wave moved along 0.20 m to right	B1
5	(a)		sin i / sin r or sin 50 / sin 30 1.5(321)	C1 A1

(b) moving from more dense to less dense medium B1
or moving to lower refractive index (air)
angle of incidence is greater than critical angle B1

(c) less heat loss / more efficient B1
less chance of hacking / more secure / less interference
less reduction in signal / less need for boosting / larger distances possible / thinner or less bulky

6 **(a)** **(i)** (I=) V / R or 6/60 C1
0.1(0) A A1

(ii) (I=) P / V or 0.9 / 6 C1
or 0.15 (A) seen
0.25 A A1

(b) **(i)** lamp correctly drawn in series with resistor but not the lamp B1

(ii) less voltage (across lamp) **because** some voltage across resistor / shares voltage with resistor B1
or less current **because** of effect of resistor

7 **(a)** field lines **of magnet** mentioned or magnetic flux mentioned B1
field lines cut the coil or flux changes B1

(b) reversed movement of magnet causes one of B1
- reversal of (induced) emf
- reversal of (induced) current
- field lines cut / flux change in reverse direction

LED emits light when **current** passes in one direction B1

(c) more current or more induced emf B1
and flux lines cut faster or faster change in flux

8 **(a)** emission of electrons B1
emission caused by heat / high temperature B1

(b) anode positive B1
anode attracts / accelerates electrons B1
or electric field between filament and anode

(c) **two sets** of plates shown at 90° to each other with connection(s) B1
labelled y plates **and** x plates / time base B1

9	(a)	(i)	speed and mass	B2
		(ii)	**1** speed and direction **or** distance / time and direction **or** displacement / time	B1
			2 direction changes	B1
		(iii)	force of gravity from / towards Earth	B1
			force is centripetal **or** at right angles to motion / velocity	B1
	(b)	(i)	450 000 N	B1
		(ii)	(a =) F/m or 50 000 / 40 000	C1
			1.25 m / s^2	A1
	(c)	(i)	same change in velocity / speed	M1
			in same time period	A1
		(ii)	start at origin and straight line for first 4 minutes	B1
			gradient increases at first after 4 and then decreases	B1
			constant speed from 10 minutes until 12 minutes	B1
		(iii)	area **under** graph	B1
10	(a)		(liquid) molecules not arranged (so) regularly	B1
			(liquid) molecules not vibrating / moving in same direction **or** do not have same speed	B1
	(b)	(i)	molecules / liquid escape (from surface) / break bonds	B1
		(ii)	fast moving / more energetic molecules evaporate / escape	B1
			leaving slow molecules **or** molecules with less **kinetic** energy (on average)	B1
	(c)	(i)	hot air rises	B1
		(ii)	(steam) condenses or changes to liquid (on thermometer)	B1
			or heat (conducted) from hot to cold gives out latent heat (to thermometer) **or** explanation involving bonds being made	B1

	(iii)	1	(E =)Pt **or** 200 × 120	C1
			24 000 J	A1
		2	(E =) mcT or 100 × 4.2 × 20	C1
			8400 J	A1
		3	(E =) mL or 5 × 2250	C1
			11 250 J	A1
		4	4350 J **or** 1 – (2+3)	B1
11	(a) (i)		51	B1
	(ii)		more protons than electrons	B1
			or different number of protons and electrons	
			positive and negative do not cancel	B1
	(iii)		25 protons	B1
			a different number of neutrons	B1
	(b) (i)		147	B1
	(ii)		α has mass number 4	B1
			α has proton number 2	B1
			correct proton number for U ecf their value for α	B1
	(c) (i)		alpha particles only travel a short distance in air	B1
			or alpha particles stopped / scattered / deflected by air	
			or alpha particles ionise air	
	(ii)		particles come off in different directions	B1
			or not emitted in one line / as a ray	
			or not all the particles pass through the slit	
	(iii)		B correct shape and deflected more than A	B1
	(iv)		particles **close to / fired at** the nucleus are deflected (back) / repelled	B1
			some particles pass (straight) through	B1
			a few particles come back / large deflection or most pass (straight) through (with little deviation)	B1
			and how this explains the nucleus is small	