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Cambridge Ordinary Level

MARK SCHEME for the May/June 2015 series

5054 PHYSICS

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

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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	B1
			any line straight or curved from (40,200) to (60,500)	B1
		(ii)	$s = d / t$ or 500 / 60	C1
			8.3 m / s	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	C1
			400 N	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 ($2V_0$, $0.5P_0$)	B1
			curve through points of decreasing gradient	B1
	(c)		molecules hit sides / piston	B1
			more molecules hit per second / hit more frequently	B1
			molecular impacts create large(r) **force** (upwards on piston)	B1
4	**(a)**		oscillate / vibrate stated or described	B1
			transverse movement described	B1
	(b)		0.40 m	B1
	(c)	**(i)**	$v = f\lambda$ or (f =) v / λ or 2 / (b)	C1
			5.0 Hz	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	C1
			1.5(321)	A1

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(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 90º to each other with connection(s) B1
labelled y plates **and** x plates / time base B1

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9 (a) (i) speed and mass B2

(ii) **1** speed and direction B1
or distance / time and direction
or displacement / time

2 direction changes B1

(iii) force of gravity from / towards Earth B1
force is centripetal B1
or at right angles to motion / velocity

(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 B1
or do not have same speed

(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) B1
or explanation involving bonds being made

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(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

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