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Cambridge Ordinary Level

MARK SCHEME for the October/November 2015 series

5054 PHYSICS

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

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Section A

1	**(a)**	**(i)**	(a =)$\Delta v / t$ **or** $95 / 0.011$	C1	
			$8.6(3636) \times 10^3$ m / s^2	A1	
		(ii)	(F =)ma **or** $0.018 \times 8.63 \times 10^3$	C1	
			150 / 155(.4545) / 160 N	A1	
	(b)		line from (0, 0) to (0.011, 95) with decreasing gradient	B1	
			(becomes) horizontal at (0.011, 95)	B1	[6]
2	**(a)**		poor absorber / good reflector of (infra-red) radiation (**not** with poor emitter)	B1	
			less thermal energy absorbed	B1	
	(b)	**(i)**	(pressure / it) decreases	B1	
			molecules slow down	B1	
			less frequent / less violent (molecular) collisions **with wall**	B1	
		(ii)	(pressure difference causes) a downward force on lid **or** pressure outside > pressure inside	B1	[6]
3	**(a)**		(k.e. =)$\frac{1}{2}mv^2$	C1	
			$\frac{1}{2} \times 4.4 \times 10^4 \times 20^2$	C1	
			8.8×10^6 J	A1	
	(b)	**(i)**	$WD = F \times x_{(\parallel)}$ **or** force × distance (parallel to / in direction of force)	B1	
		(ii)	$8.8 \times 10^6 / 40$ **or** a = (–)5.0 (m / s^2) **or** t = 4.0 (s) seen	C1	
			2.2×10^5 N	A1	[6]
4	**(a)**		(point) C immediately above tip of pivot (and in middle(vertically) of screwdriver ($\pm$1 mm))	B1	
	(b)	**(i)**	0.64 N	B1	
		(ii)	arrow W vertically downwards through candidate's C or pivot	B1	
	(c)		no resultant force **or** upward force = downward force **or** force left = force right	B1	
			no resultant moment (of force) **or** clockwise moment = anticlockwise moment	B1	[5]

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5	**(a)**	**temperature** at which a liquid becomes a gas		B1	
	(b)	**(i)**	molecules close together / touching **or** closer than in gas	B1	
			randomly arranged **or** irregular structure	B1	
		(ii)	to separate / increase the distance between molecules	B1	
			work done against (intermolecular) forces **or** supply p.e. **or** break bonds	B1	[5]
6	**(a)**	**distance** from (optical) centre to focal point (principal focus)		B1	
	(b)	**(i)**	**both** Fs correctly positioned at ±1 mm	B1	
		(ii)	**two** of: paraxial ray to lens through focal point to image ray through optical centre ray through focal point and then paraxial to image (**ign.** arrows)	M2	
			X at crossing point of rays	A1	
		(iii)	3.4–3.8 cm	B1	[6]
7	**(a)**	at compression: molecules closer together **or** pressure higher **or** vice versa for rarefaction		B1	
	(b)	**(i)**	$v = f\lambda$ **or** in words	B1	
		(ii)	larger **and** because the frequency is lower	B1	
	(c)	states one use	(e.g. prenatal scanning)	B1	
		basic idea	(e.g. ultrasound reflects off foetus)	B1	[5]
8	**(a)**	**(i)**	$(I =) V/R$ **or** 12 / (6000 + 2000) **or** 12 / 8000 **or** 12 / 2000 **or** 12 / 6000 **or** in **(ii)** $(V =) IR$ **or** 0.0015 × 6000	C1	
			1.5 mA	A1	
		(ii)	9.0 V	B1	
	(b)	(reading / it) increases		B1	
		resistance of LDR falls		B1	
	(c)	light meter / sensor **or** automatic light switch **or** something sensible		B1	[6]

[45]

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Section B

9 (a) (i) (vector) has direction **or** scalar does not have direction **or**
(vectors) may cancel **or** scalars cannot cancel B1

(ii) one vector quantity e.g.: displacement; velocity, acceleration B1
one scalar quantity e.g.: distance, length, speed, time, current, resistance B1 [3]

(b) downward weight arrow of length 3.9–4.1 cm B1
correct triangle/parallelogram drawn **and** correct diagonal clear B1
270–285 kN B1
horizontal (±3°) B1

(c) (i) from chemical / fuel energy B1
to kinetic (and thermal energy) (**not** with any intermediate) B1

(ii) **air** resistance / friction / drag B1
air resistance / friction / drag increases **or** resultant force decreases
or acceleration decreases B1
resultant force is zero **or** (air) resistance / friction equals thrust B1
direction of motion is changing B1
velocity is vector **or** has a direction B1
(acceleration depends on) changing velocity **or**
resultant force towards centre (of circle) **or centripetal** force B1 [12]

[15]

10 (a) (i) at least two straight parallel lines inside the coil B1
at least two (complete) lines one above the coil and one below the coil B1
third line in middle **and** evenly spaced **and** two closed loops B1
(any crossings max. 2 / 3)

(ii) current (in X) increases B1
magnetic field becomes stronger / changes B1
current / e.m.f. / voltage **induced** in Y / electromagnetic induction B1
opposite deflection B1
larger deflection B1
magnetic field decreasing **or** quicker (rate of) change B1 [9]

(b) (i) to increase the strength of the magnetic field B1
to direct / concentrate the magnetic field (into the secondary coil) B1

(ii) ($P =)VI$ **or** $33\,000 \times 85$ C1
2.8×10^6 W **or** 2800 kW **or** 2.8 MW A1

(iii) ($E =)VIt$ **or** $33\,000 \times 85 \times 3600$ **or** $2.8 \times 10^6 \times 3600$ C1
$1.0 / 1.01 / 1.008 \times 10^{10}$ J A1 [6]

[15]

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11	**(a)**	**(i)**	(atoms) 3 **and** 4	B1	
		(ii)	(atoms) 3 **and** 5	B1	
		(iii)	(atoms) 3 **and** 4	B1	[3]
	(b)	**(i)**	17	B1	
		(ii)	35	B1	[2]
	(c)	**(i)**	two separate sources: rocks (e.g. radon), outer space (e.g. cosmic rays), man-made sources (e.g. nuclear waste / fallout)	B2	
		(ii)	22 counts / minute	B1	
		(iii)	27 counts / minute	B1	
		(iv)	**use** of 27 / 2 **or** 27 / 4 **or** 27 / 8	B1	
			from 85 to 90 days (inclusive)	B1	[6]
	(d)	**(i)**	(background count-rate is) reduced	B1	
			not to zero **or** not stopped **or** (some) gamma-rays in background count	B1	
		(ii)	not sensible	M1	
			all the beta-radiation would be absorbed **or** no beta-radiation reaches the detector	A1	[4]
					[15]

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