CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 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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Section A

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

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]

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 (any crossings max. 2 / 3)		B1	
		(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 × 85		C1	
			2.8×10^6 W **or** 2800 kW **or** 2.8 MW		A1	
		(iii)	(E =)VIt **or** 33 000 × 85 × 3600 **or** $2.8 \times 10^6 \times 3600$		C1	
			1.0 / 1.01 / 1.008 × 10^{10} J		A1	[6]
						[15]

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 from 85 to 90 days (inclusive)	B1 B1	[6]
	(d)	(i)	(background count-rate is) reduced not to zero **or** not stopped **or** (some) gamma-rays in background count	B1 B1	
		(ii)	not sensible all the beta-radiation would be absorbed **or** no beta-radiation reaches the detector	M1 A1	[4]
					[15]