



Cambridge International Examinations
Cambridge Ordinary Level

PHYSICS

5054/21

Paper 2 Theory

May/June 2016

MARK SCHEME

Maximum Mark: 75

Published

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge O Level – May/June 2016	5054	21
1	(a) air resistance is zero or no air resistance acts (at first) or weight <u>much larger</u> than air resistance		B1
	(a=) F/m or weight/mass or 600/60 or weight is 10 times mass		B1
	(b) air resistance / upwards force is larger than weight/600 N / downwards force		B1
	(c) (i) 5(.0)m/s		B1
	(ii) 120 N		B1
2	(a) (i) limit of proportionality		B1
	(ii) 250 g		B1
	(iii) 2.5 N		B1
	(b) half the extension / 10 cm		B1
	each / both / another spring shares / distributes the weight / mass or both springs bear / carry the load		B1
3	(a) (i) amount of matter / substance / material or the ability of an object to resist a change in its state of motion (when a force is applied)		B1
	(ii) $(V=) M/D$ in any form numerical or algebraic 0.13(19) cm ³		C1 A1
	(iii) $V/(l \times w)$ in any form numerical or algebraic 0.022 cm		C1 A1
	(b) micrometer (screw gauge) or calipers		B1
4	(a) greatest air; least copper		B1

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge O Level – May/June 2016	5054	21
	(b) (i) 1 difference between smallest and largest temperature or from 0 to 100 °C		B1
	(i) 2 small/moderate distance between (thermometer) marks or for a given temperature change there is a small expansion of liquid / distance (along scale) / change in thermometric property or cannot measure small temperature <u>difference / change</u>		B1
	(ii) • use liquid that expands more • smaller bore / thinner tube • more mercury (in bulb) or use larger bulb		B1
5	(a) <i>sound</i> : along or parallel (to transfer of energy or wave) and longitudinal <i>water</i> : perpendicular and transverse		B1 B1
	(b) (i) 0.29 – 0.28 m		B1
	(ii) <u>time / period</u> for one wave (length) / cycle constant or each oscillation / cycle takes one second		B1
6	(a) angle of incidence smallest angle for light to be totally internally reflected or largest angle (of incidence) for ray to be refracted / emerge or when light emerges along surface or when angle of refraction is 90°		B1 B1
	(b) (i) $n = 1 / \sin C$ algebraic or numerical 2.5 or 2.46 or 2.458(59)		C1 A1
	(ii) <i>left hand diagram</i> ray refracts away from normal and emerges into air at bottom left surface		B1
	<i>right hand diagram</i> reflected horizontal ray (by eye)		B1
	<i>right hand diagram</i> rest of ray completely correct to emerge into air at top face without refraction (by eye)		B1
7	(a) (current in coil) creates magnetic field or current is at right angles to magnetic field (of permanent / cylindrical magnets)		C1
	(b) into and out of magnet or left and right or backwards and forwards current is one way then reverses (so reverses force)		B1 B1

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge O Level – May/June 2016	5054	21
	(c) ($\lambda =$) v/f numerically or algebraic in any form 0.64 m		C1 A1
8	(a) (i) same/equal or $I_B = I_1 = I_2$		B1
	(ii) (p.d. of) battery is sum of (p.d. across) fixed resistor and (p.d. across) the variable resistor or $V_B = V_1 + V_2$		B1
	(b) ($I =$) V/R numerical or algebraic in any form 0.006(0)A		C1 A1
9	E (a) 2 squares 10V		C1 A1
	(b) measure/find horizontal distance/number of divisions (between points) distance \times no (m)s/division		C1 A1
	OR (a) transistor		B1
	(b) (in dark) resistance of LDR large/increases large voltage across base (and emitter) switches transistor on or current in <u>collector</u> increases		B1 B1 B1
10	(a) (i) temperature when solid turns to liquid		B1 B1
	(ii) molecules escape (surface) fastest molecules/most energetic molecules escape/break bonds leaving behind slower molecules/colder molecules or temperature falls		C1 A1 B1
	(b) (i) at the surface/top of liquid		B1
	(ii) less heat/energy <u>enters</u> (liquid nitrogen)/transfers or less nitrogen evaporates/boils reduces/stops conduction and convection explanation of no conduction or convection, e.g. no molecules/no medium		B1 B1 B1

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(c) (i)	nitrogen gas or nitrogen vapour		B1
(ii) 1	(Q=) mcT numerical or algebraic 216 (°C) seen 4200 J		C1 C1 A1
(ii) 2	(m=) Q/L numerical or algebraic 21 g		C1 A1
11 (a) (i)	<p>diagram showing coil of wire and either</p> <ul style="list-style-type: none"> magnet or another coil and supply (dc and switch or ac) <p>coil of wire connected to an ammeter or voltmeter or cro or other method of detection, e.g. lamp</p> <p>magnet or coil moved or <u>change in current</u> mentioned if another coil used</p>		B1 B1 B1
(ii)	<p>ANY 2 from</p> <ul style="list-style-type: none"> move magnet (or coil) faster larger current in primary (if transformer drawn) more turns in coil stronger magnet (if magnet drawn) soft iron core 		B2
(iii) 1	direction of <u>induced</u> current/ <u>induced</u> emf opposes the change (that produces it)		B1 B1
(iii) 2	(magnetic) flux/field/poles in coil caused by movement/(induced) current in coil		B1
	statement of how opposition occurs, e.g. repulsion as magnet moves in; N pole created (by induction) at end of coil as N pole approaches		B1
(b) (i) 1	(I=) P/V numerical or algebraic 15(.15) A		C1 A1
2	(E=) Pt or VI t or 500(000) × 60 × 60 1.8 × 10 ⁹ J or 500 kWh		C1 A1
(ii)	<p>low current</p> <p>P = I²R or E = I²Rt explained</p>		B1 B1

Page 6	Mark Scheme	Syllabus	Paper
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12 (a)	kinetic energy at start thermal energy/ heat energy/ internal energy at end	B1 B1
(b) (i)	0.4(0)s	B1
(ii)	(d=) $s \times t$ numerical or algebraic 2.8 m	C1 A1
(iii)	area under graph (between 0.4 and 2.4 s) or time (difference) \times <u>average</u> speed or $\frac{1}{2} \times$ time (difference) \times initial speed	B1
(iv)	horizontal line from (0,5) to (0.4,5) line showing braking with same gradient as original line	B1 B1
(v)	less friction less deceleration or graph less steep or less <u>force backwards</u> /less <u>force opposing motion</u> or same KE lost/work done by friction	B1 B1
	longer time to stop or larger area under (speed-time) graph or work = force \times distance applied correctly	B1
(c) (i)	(F=) $P \times A$ numerical or algebraic 60 N	C1 A1
(ii)	same pressure larger area (of S/brake pads)	B1 B1