



Cambridge IGCSE™

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

October/November 2022

MARK SCHEME

Maximum Mark: 40

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **3** printed pages.

Question	Answer	Marks
1	D	1
2	D	1
3	D	1
4	B	1
5	A	1
6	B	1
7	B	1
8	C	1
9	D	1
10	C	1
11	C	1
12	A	1
13	A	1
14	A	1
15	B	1
16	D	1
17	C	1
18	B	1
19	C	1
20	B	1
21	C	1
22	A	1
23	C	1
24	A	1
25	B	1
26	C	1
27	A	1
28	B	1

Question	Answer	Marks
29	D	1
30	C	1
31	B	1
32	D	1
33	D	1
34	A	1
35	D	1
36	B	1
37	B	1
38	C	1
39	A	1
40	C	1



Cambridge IGCSE™

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2022

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Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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This document consists of **16** printed pages.

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Acronyms and shorthand in the mark scheme

acronym / shorthand	explanation
A marks	Final answer marks which are awarded for fully correct final answers.
C marks	Compensatory marks which may be scored to give partial credit when final answer (A) marks for a question have not been awarded.
B marks	Independent marks which do not depend on other marks.
M marks	Method marks which must be scored before any subsequent final answer (A) marks can be scored.
Brackets ()	Words not explicitly needed in an answer, however if a contradictory word/phrase/unit to that in the brackets is seen the mark is not awarded.
<u>Underlining</u>	The underlined word (or a synonym) must be present for the mark to be scored. If the word is a technical scientific term, the word must be there.
/ or OR	Alternative answers any one of which gains the credit for that mark.
owtte	Or words to that effect.
ignore	Identifies incorrect or irrelevant points which may be disregarded, i.e., <u>not</u> treated as contradictory. Ignore is also used to indicate an insufficient answer not worthy of credit <u>on its own</u> .
CON	An incorrect point which contradicts any correct point and means the mark cannot be scored.
ecf [question part]	Indicates that a candidate using an erroneous value from the stated question part must be given credit here if the erroneous value is used correctly here.
cao	correct answer only

Question	Answer	Marks
1(a)	2.3 J $\Delta g.p.e. = mg\Delta h$ in any form or $0.50 \times 10 \times 0.45$	A2 C1
1(b)(i)	1.2 N s impulse = change in momentum or 2.0×0.60	A3 C1
	$I = m\Delta v$ in any form or 2.0×0.60	C1
1(b)(ii)		B3
	kinetic energy (of block A) decreases	B1
	thermal / internal energy produced / increases (due to friction)	B1
	friction mentioned or block slows down / decelerates	B1

Question	Answer	Marks
2(a)(i)		B2
	magnitude or size	B1
	direction	B1
2(a)(ii)		B2
	any two from: acceleration / deceleration, gravitational field strength, impulse, momentum, velocity, weight	B2
2(b)(i)	0.12 m	B1
2(b)(ii)		B2
	beyond where the extension is not directly proportional to the load or (point) where extension stops being directly proportional to the load or point up to which extension is directly proportional to the load	B1
	$10.4 \text{ N} \leq \text{weight} \leq 10.9 \text{ N}$	B1
2(b)(iii)	$22 \text{ N/m} \leq k \leq 25 \text{ N/m}$	A3
	clear subtraction of 0.12 from a length that is in Hooke's law region e.g. $0.54 - 0.12$	C1
	$k = F/x$ in any form or $k = W/x$ in any form or $k = 1/\text{gradient}$	C1

Question	Answer	Marks
3(a)	620 N	B1
3(b)		B2
	no resultant force (on object in equilibrium)	B1
	no resultant moment (on object in equilibrium)	B1
3(c)(i)	560 N m	A2
	($T = Fx_{\perp r}$ or 620×0.90)	C1
3(c)(ii)	540 N	A3
	use of any moment	C1
	$T \times 1.2 \sin 60^\circ (= 560)$ or $(T =) 560 / (1.2 \times \sin 60^\circ)$	C1

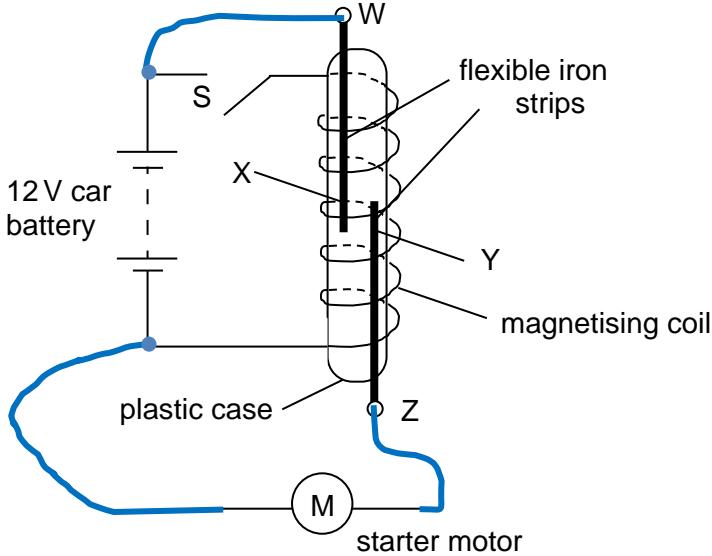
Question	Answer	Marks
4(a)(i)	240 N	A2
	$F = pA$ in any form or $1.0 \times 10^5 \times 2.4 \times 10^{-3}$	C1
4(a)(ii)	5.0 J	A2
	$WD = Fx_{\parallel}$ or 240×0.021	C1
4(b)	$(-)3.5 \times 10^3 \text{ J}$	A2
	$E = CDT$ in any form or $89 \times (21 - (-18))$ or $89 \times (3)$ or 89×39	C1
4(c)		B3
	(as the volume decreases) the particles collide more often	B1
	(as the temperature decreases) the particles collide less violently	B1
	two effects cancel (to leave the pressure unchanged) or particles collide with walls / piston / cylinder	B1
4(d)		B2
	(attractive) forces between (any two) particles large(r than in gases)	B1
	particles close(r) together (than gas particles) or particles already touching	B1

Question	Answer	Marks
5(a)	infrared	B1
5(b)(i)	(both) transverse / electromagnetic / travel in a vacuum / have the same (high) speed (in a vacuum)	B1
5(b)(ii)	(it / visible light) compared with an e.m. radiation stated by candidate in 5(a) in terms of frequency / wavelength	B1
5(c)(i)	<p>equipment</p> <p>e.g. black container, white container, thermometers or Leslie's cube and detector</p> <p>measurements made</p> <p>warm / hot water in container and temperature decreases recorded or time to reach a given temperature / to cool or warm / hot water in cube and meter readings recorded</p> <p>how a conclusion is reached</p> <p>better emitter surface cools quicker or greater reading from better emitter surface</p>	B3

Question	Answer	Marks
5(c)(ii)	<p>any two appropriate quantities</p> <p>e.g. initial temperature of water mass / volume of water dimensions / surface area of container time of cooling mass of container shape of container smoothness of surface</p> <p>or</p> <p>surface area of face (of cube) distance of detector temperature of water at time of measurement smoothness of surface</p>	B2

Question	Answer	Marks
6(a)	(light of a) single frequency	B1
6(b)(i)		B2
	angle of incidence is 0° (hence) angle of refraction is 0°	B1
	or all the wavefront hits the plastic at the same time all slows down at the same time	B1
6(b)(ii)	$1.8 \times 10^8 \text{ m / s}$	A4
	$n = 1 / \sin c$ in any form or $n = 1 / \sin 37^\circ$	C1
	$(n =) 1.7$	C1
	$v_{\text{pl}} = v_0 / n$ in any form or $3.0 \times 10^8 / 1.7$ or $3.0 \times 10^8 \times \sin 37^\circ$	C1
6(b)(iii)		B3
	critical angle (for blue light) $< 37^\circ$ or critical angle for red (light) is 37°	B1
	angle of incidence (of blue light) greater than its critical angle (in plastic)	B1
	total internal reflection or all the (blue) light reflects or no (blue) light leaves the glass / refracts / travels in air along the straight edge	B1

Question	Answer	Marks
7(a)		B3
	X and Y / they become magnetised or they / strips have poles	B1
	strips in the centre have opposite (magnetic) poles or X and Y attract	B1
	X and Y touch / close switch / activate relay / complete circuit	B1
7(b)(i)	150 A	A2
	$I = P/V$ in any form or $1.8/12$ or $1800/12$ or $1800/12$ or 0.15	C1
7(b)(ii)		B2
	small(er) resistance mentioned	B1
	less thermal energy produced or wires do not melt or large current mentioned	B1

Question	Answer	Marks
7(c)		B2
	flexible strips in series with motor	B1
	power supply in series with motor	B1
	expected answer: 	

Question	Answer	Marks
8(a)	both relate to energy per unit charge	B1
8(b)	e.m.f. applies to the whole circuit / source or p.d. to one (or more) component or energy conversion to electrical for e.m.f. or from electrical for p.d.	B1
8(c)(i)	4.8 V	B1
8(c)(ii)	20 Ω	A3
	$1/R_T = 1/R_1 + 1/R_2$ or ($R_T = R_1 R_2 / (R_1 + R_2)$) or $1/R_T = 1/24 + 1/12$ or $1/R_T = 3/24$ or ($R_T = 24 \times 12 / (24 + 12)$)	C1
	8.0 (Ω)	C1
8(c)(iii)	2.9 V	A2
	$V = ER/R_T$ in any form or $4.8 \times 12 / 20$ or $I = E/R$ in any form or 0.24 seen	C1

Question	Answer	Marks
9(a)	they all have the same number of neutrons / nucleons or they are all identical	B1
9(b)(i)		B2
	(number of protons =) 80	B1
	(number of neutrons =) 118	B1
9(b)(ii)	19 counts / minute \leqslant count rate \leqslant 21counts / minute	B1
9(b)(iii)	2.4 days $\leqslant \tau \leqslant$ 2.9 days	A4
	count rate from line – background count e.g. 390 – 20	C1
	answer from first C1 mark divided by 2 e.g. $370/2$ or 185	C1
	background count + answer from second C1 mark e.g. $20 + 370/2$ or $20 + 185$ or 205	C1



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2	D	1
3	A	1
4	C	1
5	C	1
6	A	1
7	D	1
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9	D	1
10	B	1
11	A	1
12	C	1
13	A	1
14	D	1
15	B	1
16	B	1
17	B	1
18	A	1
19	B	1
20	C	1
21	B	1
22	A	1
23	C	1
24	B	1
25	A	1
26	A	1
27	B	1
28	D	1

Question	Answer	Marks
29	A	1
30	B	1
31	B	1
32	A	1
33	A	1
34	C	1
35	C	1
36	D	1
37	D	1
38	C	1
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40	D	1



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GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
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5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Acronyms and shorthand in the mark scheme

Acronym/shorthand	Explanation
A marks	Final answer marks which are awarded for correct final answers to numerical questions.
C marks	Compensatory marks which may be scored to give partial credit when final answer (A) marks for a question have not been scored.
B marks	Independent marks which do not depend on other marks.
M marks	Method marks which must be scored before any subsequent final answer (A) marks can be scored.
Brackets ()	Words not explicitly needed in an answer however if a contradictory word/phrase/unit to that in the brackets is seen the mark cannot be scored.
<u>Underlining</u>	The underlined word (or a synonym) must be present for the mark to be scored. If the word is a technical scientific term, the word must be there.
<u>owtte</u>	Or words to that effect
<u>ignore</u>	If seen, this incorrect or irrelevant point may be disregarded, i.e. it is not to be treated as contradictory.
<u>not/NOT</u>	An incorrect point which contradicts any correct point and means the mark cannot be scored.
<u>ecf [question part]</u>	Indicates that a candidate using an erroneous value from the stated question part must be given credit here if the erroneous value is used correctly here. i.e. their error is carried forward to this question and they are not penalised a second time for one error.
<u>cao</u>	correct answer only

Question	Answer	Marks
1(a)	negative acceleration or decrease in velocity	B1
	<u>change</u> in velocity per unit time or rate of <u>change</u> of velocity	B1
1(b)	delay in applying brakes or (human) reaction time or foot not removed from accelerator	B1
1(c)(i)	gradient or slope	B1
1(c)(ii)	20.5 m / s \leqslant answer \leqslant 23.5 m / s	A2
	the coordinates at one point on curve (e.g. (0.50, 11)) and (upper) time coordinate \leqslant 1.0 s	C1
1(d)(i)	air resistance / air friction acts on the car	B1
1(d)(ii)	air resistance / resultant / resistive force decreases and as speed decreases / car decelerates	A2
	air resistance / resultant / resistive force decreases / changes	C1

Question	Answer	Marks
2(a)	gravitational potential energy	B1
2(b)(i)	$1.6 \times 10^6 \text{ Pa}$	A3
	$(p =) h\rho g$ (in any form) or $150 \times 1000 \times 10$ or 1.5×10^6	C1
	1.5×10^6 or $1.0 \times 10^5 + \{150 \times 1000 \times 10\}$ or $1.0 \times 10^5 + 1.5 \times 10^6$ or 1.6×10^6	C1
2(b)(ii)	$5.6 \times 10^6 \text{ N}$	A2
	$(F =) pA$ (in any form) or $1.6 \times 10^6 \times 3.5$	C1

Question	Answer	Marks
2(c)	speed (of water) remains constant	B1
	otherwise density would decrease or gaps would appear in the water or volume / density does not change or liquids incompressible or water enters / leaves at constant rate or quantity of water remains constant	B1

Question	Answer	Marks
3(a)	fast(er) / high(er) speed / (more) energetic molecules escape (into air)	B1
	<u>average speed</u> / <u>average kinetic</u> energy of molecules decreases	B1
	temperature related to speed / energy of molecules or slow(er) / low(er) speed / less energetic molecules remain (in water)	B1
3(b)	any three from: atoms / ions vibrate (vibrating) atoms / ions hit electrons electrons propelled / travelling through metal / moving through metal electrons hit (distant) atoms <u>free electrons</u> / <u>delocalised</u> electrons mentioned	B3

Question	Answer	Marks
4(a)(i)	two / three wires of at least two different metals	B1
	one junction in sulfur	B1
	the other junction in ice-water mixture / at room temperature and one of the wires must be from the first junction	B1
	labelled voltmeter / voltmeter symbol correctly connected	B1

Question	Answer	Marks
4(a)(ii)	measure e.m.f.	B1
	how to find temperature from e.m.f. (e.g. use calibration graph or calculation or table)	B1
4(b)	measures high temperatures / wires do not melt / rapid response / robust / small heat capacity / electrical output / (can be) remote from observer / direct input to computer	B1

Question	Answer	Marks
5(a)	<u>temperature</u>	B1
	at which liquid becomes a gas or liquid and gas exist together	B1
5(b)(i)	$1.8 \times 10^5 \text{ J}$	A2
	($E =$) VIt (in any form) or $230 \times 13 \times 60$ or 230×13 or 3000	C1
5(b)(ii)	$9.1 \times 10^{-3} \text{ kg/s}$	A4
	$\Delta T = 100 - 22$ or 78	C1
	$m = E / c\Delta T$ (in any form) or $1.8 \times 10^5 / (4200 \times 78)$	C1
	$\text{or } P / c\Delta T$ (in any form) or $m = E / c\Delta T$ and $E = Pt$	C1
5(c)	$1.8 \times 10^5 / (4200 \times 78 \times 60)$ or 5.5×10^4 or $9.1 / 9.2 \times 10^4$	C1
	$\text{or } 3000 / (4200 \times 78)$ $\text{or } 230 \times 13 / (4200 \times 78)$ $\text{or } 9.1 / 9.2 \times 10^4$	C1
	1 if the tap becomes live or if the (live) cable touches the (metal) tap	B1
	there is a current to earth / in the earth wire (which blows the fuse)	B1
	2 the current (in earth wire) is large and fuse melts / blows / stops current / breaks circuit	B1

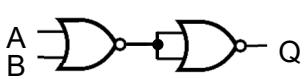
Question	Answer	Marks
6(a)	any three from: radiation light / infrared / electromagnetic (radiation) travel through space / vacuum absorbed by road	B3
6(b)	road / black surfaces are good absorbers (of radiation) or sea is a poor absorber (of radiation)	B1
6(c)(i)	they / molecules speed up or gain <u>kinetic</u> energy	B1
	they / molecules move further apart	B1
6(c)(ii)	density (of air above road) decreases or density (of hot air) decreases	B1
	air (above land / road) rises or air (that is hot) rises	B1
	air (above road) replaced by cool air / air from above sea	B1

Question	Answer	Marks
7(a)	(all the light) meets (at a point) or is focused or intersects	A2
	(all the light) travels towards a point	C1
	it then diverges or spreads out (from that point) or point of convergence is on XY / at F / the focal point / principal focus / 3.0 cm from lens	B1
7(b)	two marked points on XY 3.0 cm from centre of lens and one on left and one on right and each labelled F	B1

Question	Answer	Marks
7(c)(i)	two of these rays from tip of N drawn: ray (that seems to come) from left-hand principal focus and emerges from lens paraxially paraxial ray to lens and then towards right-hand principal focus ray towards / through centre of lens	M2
	two rays traced back to intersection and line from intersection to axis and line labelled I	A1
7(c)(ii)	virtual and light / rays do not pass through I or virtual and light / rays only seem to come from I or virtual and produced by diverging rays virtual and (real) rays do not meet	B1
7(c)(iii)	magnifying glass	B1

Question	Answer	Marks
8(a)	0.27 J	A4
	(v =) at (in any form) or 10×0.67 or 6.7 (m / s)	C1
	6.7 (m / s)	C1
	(KE =) $\frac{1}{2}mv^2$ (in any form) or $\frac{1}{2} \times 0.012 \times (10 \times 0.67)^2$ or $\frac{1}{2} \times 0.012 \times 6.7^2$	C1
8(b)(i)	<u>magnetic field</u> / <u>magnetic field lines cut the copper / tube / it</u> (or vv.)	B1
	electromagnetic <u>induction</u> occurs or e.m.f. <u>induced</u>	B1

Question	Answer	Marks
8(b)(ii)	(upwards / opposing) force on magnet	B1
	force / magnetic field / e.m.f. / current opposes the change (producing it) / opposes motion or force on magnet due to <u>magnetic field caused by current</u> in tube	B1

Question	Answer	Marks
9(a)	digital (signal) consists of 1(s) and 0(s) / high value and low	B1
	analogue (signal) is (continuously) variable (in magnitude)	B1
9(b)	NOR (gate) and 	B1
9(c)		A2
	 (i.e. NOR gate symbol with two inputs joined seen)	C1

Question	Answer	Marks
10(a)(i)	same number of protons / both have one proton	B1
10(a)(ii)	it / hydrogen-3 / ${}_{(1)}^3\text{H}$ has one more neutron	A2
	different number of neutrons / nucleons	C1

Question	Answer	Marks
10(b)(i)	(high temperature produces) high (kinetic) energy / momentum / speed / ability to do large quantity of work	B1
	they repel each other	B1
	are positively charged / have like charges or need to come close together	B1
10(b)(ii)	4_2X or 4_2He or ${}^4_2\alpha$	B1
	1_0n and no other particle	B1



Cambridge IGCSE™

PHYSICS

0625/21

Paper 1 Multiple Choice (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 40

Published

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This document consists of **3** printed pages.

Question	Answer	Marks
1	D	1
2	D	1
3	A	1
4	C	1
5	C	1
6	B	1
7	A	1
8	D	1
9	B	1
10	B	1
11	A	1
12	C	1
13	B	1
14	C	1
15	D	1
16	B	1
17	D	1
18	B	1
19	B	1
20	C	1
21	D	1
22	A	1
23	C	1
24	B	1
25	B	1
26	B	1
27	C	1
28	D	1

Question	Answer	Marks
29	B	1
30	D	1
31	C	1
32	A	1
33	C	1
34	C	1
35	A	1
36	D	1
37	C	1
38	A	1
39	B	1
40	A	1



Cambridge IGCSE™

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2021

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- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Examples of how to apply the list rule
State three reasons.... [3]

A

1	Correct	✓	2
2	Correct	✓	
3	Wrong	✗	

B

(4 responses)

1	Correct, Correct	✓, ✓	3
2	Correct	✓	
3	Wrong	ignore	

C

(4 responses)

1	Correct	✓	2
2	Correct, Wrong	✓, ✗	
3	Correct	ignore	

D

(4 responses)

1	Correct	✓	2
2	Correct, CON (of 2.)	✗, (discount 2)	
3	Correct	✓	

E

(4 responses)

1	Correct	✓	3
2	Correct	✓	
3	Correct, Wrong	✓	

F

(4 responses)

1	Correct	✓	2
2	Correct	✓	
3	Correct CON (of 3.)	✗ (discount 3)	

G

(5 responses)

1	Correct	✓	3
2	Correct	✓	
3	Correct Correct CON (of 4.)	✓ ignore ignore	
4			
5			

H

(4 responses)

1	Correct	✓	2
2	Correct	✗	
3	CON (of 2.) Correct	(discount 2) ✓	

I

(4 responses)

1	Correct	✓	2
2	Correct	✗	
3	Correct CON (of 2.)	✓ (discount 2)	

RM Assessor 3 annotations:

annotation	suggested use
tick	mark awarded (note the ticks are added up next to the tick annotation, check the total you enter agrees)
cross	no mark awarded
SEEN	indicates page seen
BOD	benefit of doubt given
NBOD	no benefit of doubt given
on page comment	gives a text box to write comment –much easier to use than in the previous version of RM assessor
ECF	error carried forward
^	omission mark
?	unclear
U UU	unit penalty applied unit penalty not applied because already applied earlier in same question

annotation	suggested use
wavy line (horizontal or vertical)	used to highlight a particular point
CON	contradiction
NAQ	not answered question
PD	poor diagram
SF SFSF	error in number of significant figures significant figure error not penalized.
POT	power-of-ten error
POT POT	POT penalty not applied as already applied
TV	too vague
I	ignore
SC	special case

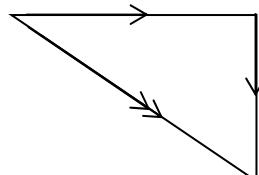
NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it . For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	In general, A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
Brackets ()	Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given. However, if a word in brackets is replaced with another word that is clearly wrong then the mark should not be awarded.
<u>Underlining</u>	Underlining indicates that this must be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
eeoo.	This means "each error or omission".
owtte.	This means "or words to that effect".
Ignore	This indicates that something which is not correct or irrelevant i.e. it is not a contradiction (CON) is to be disregarded and does not incur a penalty.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not/NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but only applies to marks annotated ecf in the mark scheme. Always annotate ecf if applied.
cao	correct answer only
Significant Figures	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question . No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Annotate with U. For more than one unit error in a question, annotate UU to indicate an error which has not been penalised. Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. kg m s^{-2} for N is NOT acceptable. The following are acceptable alternatives: Nm for J, Js^{-1} or Nms^{-1} for W, Nm^{-2} for Pa, Ns and kg m s^{-1} are both acceptable for both momentum and impulse. Beware : J NOT acceptable for moments. Condone wrong use of upper and lower case symbols, e.g. pA for Pa.
Arithmetic errors	If the only error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one mark lower than the maximum mark. Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. Do not penalise the same POT error more than once. Annotate POT POT. However if the power-of-ten error is due to the wrong omission or inclusion of g (= 10 N/kg) this rule does not apply. The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error.
Transcription errors	If the only error in arriving at a final answer is because previously calculated data has clearly been misread, but used correctly, then for that part question the mark will be one less than the maximum mark.
Fractions	Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.

Crossed out Work which has been crossed out **and not replaced but can easily be read**, should be marked as if it had not been crossed out. Look to see if it has been replaced on a blank page or another part of the same page.

Use of **NR** (# or / key on the keyboard). Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)	it / a vector has a direction	B1
1(b)	two / three vectors and no more than one other quantity underlined	C1
	acceleration and momentum and velocity underlined and no others	A1
1(c)(i)	5.5 N	B1
1(c)(ii)	correct right-angled triangle / rectangle / intersecting arcs seen e.g.  (magnitude from) 9.6 to 10.0 N (angle to vertical from) 54.0 to 57.5°	B1
1(c)(iii)	any two of: equal (in magnitude) opposite (in direction) the ring is in equilibrium or no resultant force on ring or forces on ring balance	B2

Question	Answer	Marks
2(a)	(quantity of thermal) energy or energy (to increase temperature) or energy (transferred by heating)	C1
	energy to increase temperature (of an object) per degree Celsius 1 °C	A1
2(b)(i)	(internal energy) depends on kinetic energy (of molecules)	B1
	kinetic energy (of molecules) decreases or potential energy (of molecules) decreases	B1
2(b)(ii)	$(\Delta E =) mc\Delta T$ in any form or $0.24 \times 4200 \times 17$	C1
	$1.7 \times 10^4 \text{ J}$	A1
2(c)(i)	k.e. of <u>molecules</u> / (thermal) energy absorbed (from water / surroundings) or energy absorbed from (cooling) water	B1
	supplies latent heat or energy used to overcome intermolecular forces / to break bonds	B1
2(c)(ii)	any determination of mass	B1
	determine change in mass (of ice) / increase in mass of water or dry the ice or ensure water is at 0 °C / equilibrium is established or insulate the beaker	B1
	use ($l_f =$) E / m in any form	B1

Question	Answer	Marks
3(a)	<p>any three of: they / molecules collide with inner surface momentum (of a molecule) changes / reverses force exerted / impulse force spread over area / surface or $p = F/A$</p>	B3
3(b)(i)	$(V_2 =) p_1 V_1 / p_2$ in any form or $630 \times 1.0 \times 10^5 / 1.4 \times 10^5$	C1
	450 cm^3 or $4.5 \times 10^{-4} \text{ cm}^3$ or 0.45 dm^3	A1
3(b)(ii)	<p>any two of: <u>molecules</u> move more slowly / have less kinetic energy pressure (inside balloon) decreases or pressure is directly proportional to temperature or $p \propto T$ volume is directly proportional to temperature or $V \propto T$ molecular collisions less frequent molecular collisions less violent / hard / exert smaller impulse water / external pressure compresses balloon or water pressure greater (and balloon compressed)</p>	B2

Question	Answer	Marks
4(a)(i)	straight line begins at (15 s, 120 m) and continues to end of given line	B1
4(a)(ii)	curve with increasing gradient from origin to beginning of candidate's (a)(i)	B1
4(b)	($E_k =$) $\frac{1}{2}mv^2$ in any form	C1
	$\frac{1}{2} \times 1.8 \times 10^5 \times 20^2$	C1
	$3.6 \times 10^7 \text{ J}$	A1
4(c)(i)	(work done =) force \times distance (moved in the direction of the force)	C1
	(work done =) force \times distance moved in the direction of the force	A1
4(c)(ii)	240 m c.a.o.	B1
4(c)(iii)	$3.6 \times 10^7 / 240$ or kinetic energy / distance or ($a =$) $20 / 24$ or $\Delta v / t$ in any form or 0.83 or ($F =$) ma in any form	C1
	$1.5 \times 10^5 \text{ N}$	A1

Question	Answer	Marks
5(a)	(point) where (parallel) rays (of light) meet (after passing through lens)	C1
	point) where parallel rays (of light) meet / are focussed (after passing through lens) or (point) through which rays (of light) that emerge parallel pass (before reaching lens)	A1
5(b)	distance between principal focus / focal point and optical centre / lens	B1
5(c)(i)	vertical line labelled L $4.0 (\pm 0.2)$ cm to the right of O	B1
5(c)(ii)	paraxial ray from tip of O to candidate's lens and from lens to tip of I or paraxial ray from lens to tip of I and from tip of O to candidate's lens	C1
	3.0 (± 0.2) cm	A1
5(c)(iii)	fourth box ticked i.e: 	B1
	reversed / inverted	B1

Question	Answer	Marks
6(a)(i)	(J) ultraviolet (radiation) (K) infrared (radiation) (L) radio (waves)	
	two correct	C1
	all three correct	A1
6(a)(ii)	L or radio (waves)	B1
6(b)	$(c =) 3.0 \times 10^8 \text{ (m / s) seen}$	C1
	$(f =) v / \lambda$ in any form or $3.0 \times 10^8 / 1.2 \times 10^{-9}$	C1
	$2.5 \times 10^{17} \text{ Hz}$	A1
6(c)(i)	stated <u>medical</u> use (e.g. treating cancer / X-ray shadowgraph / sterilising equipment)	B1
	statement of what happens to the X-rays (e.g. absorbed by tumour / bones / bacteria)	B1
	stated consequence (e.g. tumour killed or image / picture / shadow / photograph produced)	B1
6(c)(ii)	can cause burns / (cell) mutation / cell damage / tumours / cancer / damages DNA etc.	B1

Question	Answer	Marks
7(a)	electrons mentioned	B1
	negative charges / electrons move from cloth or move to rod	B1
7(b)(i)	electrons / negative charge(s) repelled to earth or ball charged by induction	B1
	ball positively charged	B1
	opposite charges attract	B1
7(b)(ii)	negatively charged (by rod) or ball discharges / becomes neutral	B1
	repelled by rod or pulled down by gravity / its weight	B1

Question	Answer	Marks		
8(a)	Q/t or (rate of) flow of (electric) charge / electrons	B1		
8(b)	(current in the $450\ \Omega$ resistor =) $I_2 - I_1$	B1		
8(c)	$(V_{450\ \Omega} =) IR$ or 0.012×450 or $5.4\ (V)$ or $9.0 - 5.4$ or $3.6\ (V)$ seen	C1		
	$(I =) 3.6 / 800$ or $0.0045\ (A)$	C1		
	$(P =) VI$ or 3.6×0.0045 or $3.6^2 / 800$	C1		
	$1.6 \times 10^{-2}\ W$ or $16\ mW$	A1		
8(d)	resistance (of LDR) decreases	B1		
	current (in circuit) increases	or	resistance of parallel pair decreases	C1
	p.d. across $800\ \Omega$ resistor increases and p.d. across $450\ \Omega$ resistor decreases	or	resistance of parallel pair a smaller fraction of total resistance and p.d. across $450\ \Omega$ resistor decreases	A1

Question	Answer	Marks
9(a)	(very small) nucleus and surrounded by electrons (in orbit / shells)	B1
	92 protons or 92 electrons or number of protons = number of electrons	B1
	protons and neutrons in nucleus	B1
	143 neutrons	B1
9(b)	(uranium-238 has) three more neutrons (in nucleus)	B1
9(c)	$^{94}_{(38)}(\text{E})$	B1
	$^{(94)}_{38}(\text{E})$	B1
9(d)(i)	55	B1
9(d)(ii)	140	B1



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11	C	1
12	A	1
13	B	1
14	C	1
15	D	1
16	A	1
17	C	1
18	C	1
19	A	1
20	C	1
21	D	1
22	C	1
23	B	1
24	B	1
25	A	1
26	B	1
27	B	1
28	C	1

Question	Answer	Marks
29	A	1
30	C	1
31	A	1
32	C	1
33	A	1
34	B	1
35	A	1
36	C	1
37	C	1
38	D	1
39	A	1
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- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards ***n***.
- Incorrect responses should not be awarded credit but will still count towards ***n***.
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

- B marks are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
- M marks are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
- C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
- A marks A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. However, an A mark following an M mark is a dependent mark and is only awarded if the M mark has been awarded.
- Brackets () Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given. However, if a word in brackets is replaced with another word that is clearly wrong then the mark should not be awarded.
- Underlining Underlining indicates that this **must** be seen in the answer offered, or something very similar.
- OR / or This indicates alternative answers, any one of which is satisfactory for scoring the marks.
- eeoo. This means 'each error or omission'.
- owtte. This means 'or words to that effect'.
- Ignore This indicates that something which is not correct or irrelevant, i.e. it is not a contradiction (CON) is to be disregarded and does not incur a penalty.
- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not / NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
ecf	meaning ‘error carried forward’ is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but only applies to marks annotated ecf in the mark scheme. <u>Always annotate ecf if applied.</u>
cao	correct answer only
Significant Figures	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme. Annotate with SF from the toolbar. A second (or further) sig. fig. error in a single question is not penalised; annotate with SF SF. It is normally acceptable to quote just 1 s.f. for answers, which are exact to 1 s.f
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question . No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Unless listed here or stated in the mark scheme for the question, do not accept derived units, e.g. kg m s^{-2} for N is NOT acceptable. The following are acceptable alternatives: Nm for J, Js^{-1} or Nms^{-1} for W, Nm^{-2} for Pa, Ns and kg m s^{-1} are both acceptable for both momentum and impulse. Beware : J NOT acceptable for moments. Condone wrong use of upper and lower-case symbols, e.g. pa for Pa. Annotate with U. For more than one unit error in a question, annotate UU to indicate an error which has not been penalised.
Arithmetic errors	If the only error in arriving at a final answer is clearly an arithmetic one, then the mark awarded will be one-mark lower than the maximum mark. Regard a power-of-ten error as an arithmetic error unless otherwise specified in the mark scheme. Annotate with POT. The use of a wrong SI prefix in the final answer is counted as a power-of-ten error rather than a unit error. However, if the power-of-ten error is due to the wrong omission or inclusion of g ($= 10 \text{ N/kg}$) this rule does not apply.
Transcription errors	If the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly, one mark of that part question is negated
Fractions	Allow these only where specified in the mark scheme; they are a form of sig. fig. error; annotate with SF. Consequently, when a sig. fig. error and a fraction is used in the same question, the second answer may still be awarded full marks.
Crossed out work	Work which has been crossed out and not replaced but can easily be read , should be marked as if it had not been crossed out. Look to see if it has been replaced on a blank page or another part of the same page.

Use of NR (# or / key on the keyboard). Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

RM Assessor 3

Please note that 0625 papers are now marked using RM assessor 3. Videos and documents are available by using the Help icon in the top right-hand corner when logged in or from the RM support site. Familiarisation mode is also available on RM Assessor 3. The tool bar is now located on the left of the screen and you drag items used frequently to the right hand side of the tool bar. **Note:** the tool bar won't be visible until you have scripts to mark rather than just browse.

RM Assessor 3 annotations:

annotation	suggested use
tick	mark awarded (note the ticks are added up next to the tick annotation, check the total you enter agrees)
cross	no mark awarded
SEEN	indicates page seen
BOD	benefit of doubt given
NBOD	no benefit of doubt given
on page comment	gives a text box to write comment –much easier to use than in the previous version of RM assessor
ECF	error carried forward

annotation	suggested use
wavy line (horizontal or vertical)	used to highlight a particular point
CON	contradiction
NAQ	not answered question
PD	poor diagram
SF SFSF	error in number of significant figures significant figure error not penalized.
POT	power-of-ten error
large dot (red blob)	used to indicate a point has been seen

annotation	suggested use
^	omission mark
?	unclear
U UU	unit penalty applied unit penalty not applied because already applied earlier in same question

annotation	suggested use
TV	too vague
I	ignore
SC	special case

Guidance on the expression : words, symbols or numbers

Accept numbers if, in the context of the question, that number can reasonably be a value for the quantity in the equation/formula.

Accept alternative symbols that can reasonably represent the quantity in the equation but not if there is confusion with another quantity that is represented by that symbol in the syllabus, e.g. Q is often acceptable for thermal energy but not if, as has happened, there is confusion with charge.

Linking pages to other questions RM Assessor

It is not unusual for candidates to write all or parts of answers to question outside the normal marking zone for that question. It is absolutely vital that such work is marked. Examiners need to follow up cases where candidates reach the end of the answer zone in the middle of a sentence or cross out all the work that fills the answer zone, or use an asterisk or arrowed line or otherwise to suggest that an answer is completed or replaced elsewhere on the paper.

If all the extra work is clearly visible **in the next marking zone** there is no need to link it.

In all other cases where there is extra work that cannot be seen in the normal marking zone, examiners will need to use full screen mode to find the page which needs linking to a particular question and click 'link to question'. The page is then automatically linked to that question and will appear below the zone for that question when marked.

Blank Pages and Blank AOs

Page 18, 19 and 20 of the answer book is. They are linked to Q1(a).

Annotate with SEEN from toolbar to show that you have seen it.

Additional objects will appear as soon as you start to mark a script containing them. On each page of the additional objects you will see the option to 'flag as seen' or 'link to question'. This must be done for each of the additional objects. Links will appear when the linked question/questions is/are opened for marking.

Annotation

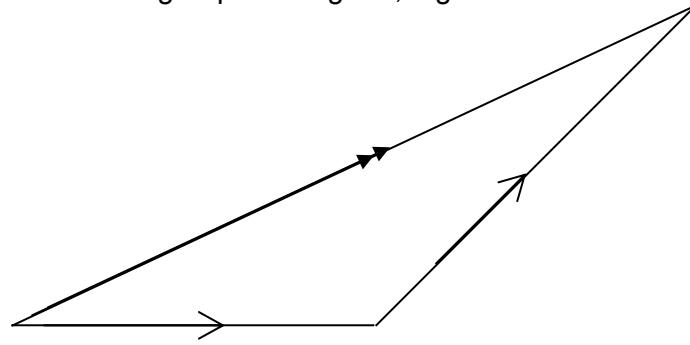
To increase marking transparency, reduce the number of enquiries about results and assist team leaders, the following is mandatory:

For **all** questions with two or more marks, examiners should tick to indicate where each credit is awarded.

For questions with one mark, examiners do not need to annotate the script to indicate that credit is awarded.

Any text annotation or annotation in a comment box should never contain -1 or allow a possible misinterpretation that negative marking was applied.

Normally place the ticks close to where the mark is scored.

Question	Answer	Marks
1(a)	$(p =) mv$ (in any form) or 0.16×15	C1
	2.4 kg m / s	A1
1(b)(i)	3.0 N s and at 45° to the original direction	B1
1(b)(ii)	vector triangle / parallelogram, e.g.:	B1
		
	scale indicated or correct triangle / parallelogram	B1
	$4.8 \text{ kg m / s} \leqslant \text{magnitude} \leqslant 5.2 \text{ kg m / s}$	B1
	22° (to original direction) \leqslant direction $\leqslant 28^\circ$ (to original direction)	B1

Question	Answer	Marks
2(a)	it / velocity / speed changes / increases (with time)	C1
	it / velocity / speed <u>increases</u> at constant rate / steadily	A1
2(b)	any three from: • (initial) acceleration caused by weight / force of gravity • acceleration decreases • drag / resistance force increases (with speed) • (finally / at terminal velocity) no acceleration / constant speed • (finally / at terminal velocity) no resultant force	B3
2(c)(i)	(GPE =) $mg(\Delta)h$ (in any form) or $0.0021 \times 10 \times 0.80$ or $2.1 \times 10 \times 0.80$ or 17 (J)	C1
	0.017 J	A1
2(c)(ii)	$(KE =) \frac{1}{2}mv^2$ (in any form)	C1
	$\frac{1}{2} \times 0.0021 \times 1.2^2$ or $\frac{1}{2} \times 2.1 \times 1.2^2$ or 1.5 (J)	C1
	1.5×10^{-3} J	A1
2(c)(iii)	(work done against) friction / drag / resistance or thermal energy generated or (displaced) liquid gains gravitational potential energy	B1

Question	Answer	Marks
3(a)	$(p_{\text{liq}} =) h\rho g$ (in any form) or $0.400 \times 1000 \times 10$ or 2000 or 4000 or 1.02×10^5 (Pa)	C1
	$(p =) p_{\text{atm}} + h\rho g$ (in any form) or $1.00 \times 10^5 + 0.400 \times 1000 \times 10$ or 4000 or 1.02×10^5 (Pa)	C1
	1.04×10^5 Pa	A1
3(b)(i)	$(F =) pA$ (in any form) or 4000×0.025	C1
	100 N	A1
3(b)(ii)	$(W.D. =) F \times x$ (in any form) or $1.04 \times 10^5 \times 0.025 \times 0.50$ or 4000 $\times 0.025 \times 0.50$ or 50 (J)	C1
	1300 J	A1

Question	Answer	Marks
4(a)	molecules close(r)	B1
	molecules move only small distances (between collisions) or do not move freely	B1
	molecules move in clusters or slide past each other	B1
4(b)	molecules (in liquid) move faster or gain energy	B1
	molecules move apart (on average)	B1
4(c)(i)	molecules overcome forces / gain potential energy as the liquid boils	B1
4(c)(ii)	$(m =) \rho V$ (in any form) or 0.86×50 or 43 (g)	C1
	$(l_v =) Q \div m$ (in any form) or $18\,000 \div 43$ or $18\,000 \div (0.86 \times 50)$	C1
	420 J/g or 4.2×10^5 J/kg	A1

Question	Answer	Marks
5(a)	electrons mentioned	B1
	electrons travel (a great distance) through the metal or (vibrating) atoms hit (free) electrons	B1
	electrons hit (distant) particles or transfer energy (to distant atoms)	B1
5(b)	shiny surfaces are poor emitters (of radiation)	B1
	infrared / radiation / mentioned	B1
	less energy lost or lost energy does not need to be supplied	B1
5(c)	less thermal energy emitted or less space for energy to be lost	B1

Question	Answer	Marks
6(a)	speed changes or (wave) speed is smaller in right-hand part of tank or waves slow down or bottom (on the page) section of wave hits the boundary first	C1
	(wave) speed is smaller in right-hand part of tank or waves slow down or bottom (on the page) section of wave hits the boundary first	C1
	bottom (on the page) / one part / one side / one section of wave slows down first (and different sections are delayed by different amounts)	A1
6(b)(i)	$(f =) v \div \lambda$ (in any form) or $0.39 \div 0.052$ or $0.39 \div 0.026$ or 15 (Hz) or $0.39 \div 5.2$ or $0.39 \div 2.6$ or 0.15 (Hz) or 0.075 (Hz)	C1
	$0.39 \div 0.052$ or 15 (Hz) or $0.39 \div 5.2$ or 0.15 (Hz) or 0.075 (Hz)	C1
	7.5 Hz	A1
6(b)(ii)	angle of incidence / $i = 45^\circ$ or angle of refraction / $r = 33^\circ$	C1
	$(v_2 =) v_1 \times \sin(r) \div \sin(i)$ (in any form) or $\lambda_2 = \lambda_1 \times \sin(r) \div \sin(i)$ (in any form) or $0.39 \times \sin(33^\circ) \div \sin(45^\circ)$ or $0.39 \times \sin(57^\circ) \div \sin(45^\circ)$	C1
	0.30 m / s	A1

Question	Answer	Marks
7(a)	steel (<u>underlined</u>)	B1
7(b)(i)	the direction of the force on a N-pole and left to right / N to S	B1
7(b)(ii)	beam deflects	B1
	beam deflects <u>into</u> the page	B1
	moving electrons / charges constitute a current or left-hand rule or moving electrons / current in a magnetic field experiences a force	B1
7(b)	(part of) beam deflects	B1
	α -particles deflect in opposite / different direction to β -particles / electrons or all α -particles have similar deflections or α -particles deflect less	B1
	γ -rays do not deflect	B1

Question	Answer	Marks
8(a)	(related to) energy supplied in driving charge in a circuit / conductor or property of source / battery / cell / power supply	B1
	energy supplied per / to unit charge or energy transferred to electrical energy or from other form of energy or energy in driving charge around a complete circuit	B1
8(b)(i)	$(I = V \div R = 240 \div 30 =) 8.0 \text{ A}$	B1
8(b)(ii)	$(P =) VI$ or 240×8.0	C1
	1900 W	A1
8(b)(iii)1	half (the size)	B1
	(equal voltage / p.d. / e.m.f. and) resistance is twice the size or I and R are inversely proportional	B1
8(b)(iii)2	(fuse rating =) 13 A / 14 A / 15 A / 16 A / 17 A / 18 A / 19 A	B1
	total current is 12.1 A	B1

Question	Answer	Marks
9(a)(i)	wave / light / energy / ray is completely / entirely reflected (at the boundary between two media) or no refraction or no wave / light / energy / ray passes into second medium / across boundary or only reflection occurs	B1
9(a)(ii)	light (must pass) from medium where it travels slower or to medium where it is faster or from medium with larger refractive index or to medium with smaller refractive index	B1
	angle of incidence (must be) greater than the critical angle / $\sin^{-1}(1 \div n)$	B1
9(b)	light / infrared travels in fibre	B1
	total internal reflection at <u>inner</u> surface or <u>within</u> (graded-index) fibre	B1
	light carries information / signal / data / message or signal / light encoded	B1

Question	Answer	Marks
10(a)	radiation that is always present or due to environment or in everyday life	B1
	soil / rocks / earth / cosmic rays / space / Sun / weapons testing / radon / nuclear waste	B1
10(b)(i)	alpha-emission (only)	B1
	alpha-particles do not penetrate (two sheets of) paper or β -particles and γ -rays pass through (two sheets of) paper	B1
10(b)(ii)	$^{208}_{84}\text{Po} \rightarrow {}_2^4\alpha / {}_2^4\text{He}$	B1
	$^{204}\text{Pb} \dots \text{ or } {}_{82}^{204}\text{Pb}$	C1
	${}_{82}^{204}\text{Pb}$	A1



Cambridge IGCSE™

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 40

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **3** printed pages.

Question	Answer	Marks
1	B	1
2	A	1
3	A	1
4	C	1
5	D	1
6	B	1
7	C	1
8	A	1
9	A	1
10	C	1
11	B	1
12	A	1
13	C	1
14	B	1
15	A	1
16	C	1
17	A	1
18	A	1
19	C	1
20	A	1
21	B	1
22	C	1
23	C	1
24	A	1
25	C	1
26	C	1
27	B	1
28	C	1

Question	Answer	Marks
29	C	1
30	A	1
31	B	1
32	A	1
33	C	1
34	B	1
35	B	1
36	C	1
37	A	1
38	D	1
39	A	1
40	A	1



Cambridge IGCSE™

PHYSICS

0625/41

Paper 4 Extended Theory

May/June 2020

MARK SCHEME

Maximum Mark: 80

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

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Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **10** printed pages.

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

- 1 Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
- 2 The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
- 3 Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
- 4 The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

5 'List rule' guidance

For questions that require ***n*** responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (*a*) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)(i)	($a = (v - u) / t$ OR $(62 - 6.0) / 35$ OR $56 / 35$)	C1
	1.6 m/s^2	A1
1(a)(ii)	($F = ma$ OR $\Delta p / \Delta t$ OR $2.5 \times 10^5 \times 1.6$ OR $(62 \times 2.5 \times 10^5 - 6.0 \times 2.5 \times 10^5) / 35$)	C1
	$4.0 \times 10^5 \text{ N}$	A1
1(a)(iii)	($p = mv$ OR $2.5 \times 10^5 \times 6.0$)	C1
	$1.5 \times 10^6 \text{ kg m/s}$	A1
1(b)	curve of decreasing gradient from (0,0) to a point along dashed line	B1
	straight line of positive gradient after $t = 35 \text{ s}$	B1
	gradient not zero at $t = 35 \text{ s}$ OR no change of gradient (at $t = 35 \text{ s}$)	B1
1(c)	thermal energy AND in something specific (e.g. brakes / air / tyres) OR kinetic energy of air	B1

Question	Answer	Marks
2(a)	0 (N) AND 8.0 N	B1
2(b)	($k = F / x$ OR $8.0 / 0.15$)	C1
	53 N/m OR 0.53 N/cm	A1
2(c)(i)	elastic potential (energy)	B1
2(c)(ii)	15 cm	B1
2(c)(iii)	7.5 cm OR $2(c)(ii) / 2$	B1

Question	Answer	Marks
3(a)	liquid levels in the two limbs of the tube are equal	B1
3(b)	molecules collide with the walls (of the container)	B1
	momentum of molecules changes (reverses)	B1
	this causes a force AND force spread out (over area of walls)	B1
3(c)(i)	$(p_2 =) p_1 V_1 / V_2 = 1.0 \times 10^5 \times 60 / 50$	C1
	$1.2 \times 10^5 \text{ Pa}$	A1
3(c)(ii)	$p_2 = p_{\text{atm}} + h\rho g$ OR $1.2 \times 10^5 - 1.0 \times 10^5$ OR 2.0×10^4 OR $(\rho =) 2.0 \times 10^4 / (0.15 \times 10)$	C1
	$1.3 \times 10^4 \text{ kg m}^{-3}$	A1

Question	Answer	Marks
4(a)	<u>temperature</u> at which liquid turns into gas	B1
4(b)(i)	$(E =) mc\Delta T$ OR $0.30 \times 4200 \times (100 - 95)$	C1
	6300 J	A1
4(b)(ii)	$(C =) E / \Delta T$ OR $6300 / 84$	C1
	$75 \text{ J/}^\circ\text{C}$	A1
4(b)(iii)	molecules do work against attractive force as they evaporate	B1
	more energetic molecules more likely to escape	B1
	average energy of remaining molecules decreases	B1

Question	Answer	Marks
5(a)	(point) where incident parallel rays meet after passing through lens OR origin of rays that emerge parallel after passing through lens	M1
	on principal axis OR use of term paraxial OR centre line	A1
5(b)(i)	enlarged virtual upright two correct answers underlined AND no more than one wrong answer underlined	M1
	three correct answers underlined AND no wrong answer underlined	A1
5(b)(ii)1	both principal focuses marked at points 5.0 cm from the optical centre	B1
5(b)(ii)2	any two construction lines from: <ul style="list-style-type: none"> • line from top of I towards far principal focus and traced back from lens horizontally • line from top of I to (and through) centre of lens • horizontal line from top of I to lens and traced back to near principal focus 	B2
	O marked with top at intersection	B1
5(b)(iii)	2.7 cm \geqslant distance \geqslant 3.1 cm	B1

Question	Answer	Marks
6(a)	$(\lambda =) v/f$ OR $340 / 20\ 000$ OR $340 / 20$	C1
	0.017 m AND 17 m	A1
6(b)	(longitudinal wave) <u>vibration</u> direction parallel to propagation / energy travel direction	B1
	transverse wave <u>vibration</u> direction perpendicular to propagation / energy travel direction	B1
	consists of rarefactions AND compressions	B1

Question	Answer	Marks
6(c)	diffraction mentioned	B1
	wavelength of sound from drum / low frequency sound greater (than wavelength of high frequency sound)	B1
	more diffraction of sound from drum OR less diffraction of high frequency sound	B1

Question	Answer	Marks
7(a)(i)	(copper) contains free electrons	B1
	good <u>electrical</u> conductor	B1
7(a)(ii)	magnetic material OR easily magnetised	B1
	temporary magnetic material OR easily demagnetised	B1
7(b)(i)	alternating / changing / varying magnetic field (produced by X)	B1
	(electromagnetic) induction in Y	B1
	(alternating) electromotive force (e.m.f.) between terminals of Y / in Y	B1
7(b)(ii)	current in X increases	B1
	to supply the power used in Y / the lamp	B1

Question	Answer	Marks
8(a)	990 / (54 / 1.2) OR 990 / 45 OR (number of cells in pack =) 54 / 1.2 OR 45	C1
	22	A1
8(b)(i)	($P =$) EI OR 1.2×3.5	C1
	4.2 W OR 4.2 J/s	A1

Question	Answer	Marks
8(b)(ii)	thick wires have a smaller resistance	B1
	less thermal energy generated in wires	B1
	more efficient OR less risk of fire / insulation melting	B1

Question	Answer	Marks
9(a)	digital signal: consists of high and low states / voltages	B1
	analogue signal: continuously varying voltage	B1
9(b)(i)	AND gate  AND OR gate 	B1
9(b)(ii)	when the inputs differ AND ‘AND gate’ produces 0 AND ‘OR gate’ produces 1	B1
9(c)(i)	both inputs to upper NOR gate are 0s	B1
9(c)(ii)	two (identical) inputs to NAND gate are 1s	M1
	lower input to lower NOR gate is 1	M1
	output Q is 0	A1

Question	Answer	Marks
10(a)	equal number of electrons OR equal number of protons	B1
10(b)(i)	$^{13}_5 X$	C1
	$^0_{-1} \beta$	C1
	$^{13}_6 Y$	A1
10(b)(ii)	any three from: <ul style="list-style-type: none">• β-particles have charge of smaller size• β-particles have smaller mass• β-particles have less energy• β-particles travel faster / less time near to air molecule• effect/force on electrons in air molecules less	B3

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

October/November 2019

MARK SCHEME

Maximum Mark: 40

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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This document consists of 3 printed pages.

Question	Answer	Marks
1	C	1
2	C	1
3	B	1
4	C	1
5	D	1
6	B	1
7	D	1
8	C	1
9	B	1
10	C	1
11	D	1
12	C	1
13	C	1
14	B	1
15	C	1
16	D	1
17	A	1
18	A	1
19	C	1
20	B	1
21	A	1
22	C	1
23	A	1
24	D	1
25	D	1
26	D	1
27	C	1
28	D	1

Question	Answer	Marks
29	B	1
30	D	1
31	A	1
32	B	1
33	B	1
34	C	1
35	B	1
36	C	1
37	A	1
38	A	1
39	B	1
40	A	1

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2019

MARK SCHEME

Maximum Mark: 80

Published

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This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	$a = \Delta v / \Delta t$ or $a = (v - u) / t$ in any form words, symbols or numbers or ($a =$) $\Delta v / \Delta t$ or ($a =$) $(v - u) / t$ or $15 (- 0) / 5.0$ or ($a =$) gradient $3.0 \text{ m} / \text{s}^2$	C1 A1
1(a)(ii)	($F =$) ma in any form words, symbols or numbers or ($F =$) ma or 2300×3.0 6900 N	C1 A1
1(b)	accelerating or speed/velocity increasing at a decreasing rate or acceleration decreasing gradient (of graph is positive and) decreasing	B1 B1 B1
1(c)	air resistance or friction mentioned or resistive force air resistance or friction or resistive force increases (with speed)	B1 B1

Question	Answer	Marks
2(a)	any two from: shape size/volume/length/density/any linear dimension direction (of motion)/speed/velocity/momentum/kinetic energy/acceleration	B2
2(b)(i)	extension and tension/force/load mentioned extension is directly proportional to tension/force/load	C1 A1
2(b)(ii)1.	260 N	B1
2(b)(ii)2.	$k = F/x$ in any form words, symbols or numbers or ($k =$) F/x or $260/(0.94 - 0.63)$ or $260/0.31$ 840 N/m	C1 A1
2(b)(iii)	from chemical (potential energy) to elastic (potential) / strain (at end)	B1 B1

Question	Answer	Marks
3(a)	force \times time (for which it acts)	B1
3(b)(i)	$v = I/m$ or $0.019/0.00011$ in any form words, symbols or numbers or ($v =$) I/m 170 m/s	C1 A1
3(b)(ii)	$KE = \frac{1}{2}mv^2$ in any form words, symbols or numbers or ($KE =$) $\frac{1}{2}mv^2$ $0.50 \times 0.00011 \times 170^2$ 1.6 J or 1.7 J	C1 C1 A1
3(c)	accept reverse comments if clearly about how the molecular structure of a solid differs from that of a liquid (molecules/they) have an irregular arrangement/not ordered/random arrangement (molecules/they) are (slightly) further apart (on average) (molecules/they are) not fixed in place	B1 B1 B1

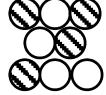
Question	Answer	Marks
4(a)	it/cone vibrates any two from: alternating current (a.c.) (in coil/wire) or alternating magnetic field (neighbouring) air vibrates or vibrations passed on (producing) compressions and rarefactions/vibrations parallel to energy transfer vibrating at 15 000 Hz	B1 B2
4(b)	$\lambda = v/f$ in any form words, symbols or numbers or ($\lambda = v/f$ or $330/15\,000$) 0.022 m	C1 A1
4(c)	at least two vertical wavefronts either to left of barrier or in gap at least one wavefront showing some diffraction approximately constant wavelength throughout and ~50% of gap width	B1 B1 B1

Question	Answer	Marks
5(a)	four or more radial arrows/lines outside surface at least one arrow pointing towards (centre of) sphere and none wrong	B1 B1
5(b)(i)	positive charges on left and negative charges on right of S equal numbers	M1 A1
5(b)(ii)	it moves towards/attracted towards the negatively charged sphere/to the left	B1
5(b)(iii)	electrons/negative charges move (along the wire) towards Earth/towards ground/down the wire S becomes positively charged	B1 B1
5(c)	electrons mentioned free (to move)/delocalised/mobile in metals/S or fixed in position in plastic/stand	M1 A1

Question	Answer			Marks
6(a)(i)	$I = P/V$ or in any form words, symbols or numbers or ($I = P/V$) or 9000/230 39 A			C1 A1
6(a)(ii)	40 A or any greater integer value (in A) up to and including 60 A			B1
6(b)	$E = Pt$ or in any form words, symbols or numbers or ($E = Pt$) or 9000×1.0 or <u>9000 J</u> seen $35 - 16$ or 19 ($^{\circ}\text{C}$) seen $m = E/(c\Delta T)$ or in any form words, symbols or numbers or ($m = E/(c\Delta T)$) or $9000/(4200 \times 19)$ 0.11 kg			C1 C1 C1 A1
6(c)(i)	two different metal wires <u>joined</u> at one end and voltmeter between free ends	or	three metal wires and two different <u>joined</u> ABA and voltmeter between free ends	B1 B1
6(c)(ii)	any one from: quick response/makes measurements fast measures rapidly varying temperatures electrical output small heat capacity robust/rugged			B1

Question	Answer	Marks
7(a)	7/7.6/8/10 marked towards top of <i>y</i> -axis and 1(0) towards right of <i>x</i> -axis a straight line of positive gradient from 0, 0 to point 1.0, 7.6	B1 B1
7(b)(i)	energy (transferred) per unit charge energy (transferred) from chemical or energy (transferred) to electrical or energy (transferred) around/in a (complete) circuit	B1 B1
7(b)(ii)	1. $I = V/R$ or in any form words, symbols or numbers or ($I =$) V/R or 12/7.6 1.6 A	C1 A1
	2. 4.2 V or 4.3 V	B1
	3. $Q = It$ or in any form words, symbols or numbers or ($Q =$) It or $1.6 \times 5.5 \times 60$ or 1.6×5.5 or 8.8(C) 520 C or 530 C	C1 A1

Question	Answer	Marks
8(a)(i)	$n = \sin(i)/\sin(r)$ in any form words, symbols or numbers or ($n = \sin(i)/\sin(r)$ or $\sin(53^\circ)/\sin(30^\circ)$) 1.6	C1 A1
8(a)(ii)	path emerging into air along correct path (by eye) and labelled R	B1
8(a)(iii)	ratio/division of two identical quantities/speeds/sine functions / (pure) numbers	B1
8(b)(i)	path labelled V with two correct refractions and below path of red light in glass	B1
8(b)(ii)	larger frequency results in smaller speed (in glass) or r.a. (reverse argument) or inversely related / proportional. any two from: more refraction/closer to normal/larger refractive index for larger frequency or r.a. violet light has larger frequency or o.r.a. violet light has a smaller speed (in glass) or o.r.a. violet light has larger refractive index or o.r.a.	B1 B2

Question	Answer	Marks
9(a)(i)	${}^8_3(\text{Li})$	B1
9(a)(ii)	 4 ×  4 × ○ electron	B1 B1 B1
9(b)(i)	radioactive emission / (background) radiation / decay is random	B1
9(b)(ii)	any one of: rocks, buildings, soil, Earth, space, cosmic rays, Sun, radon, nuclear waste, weapons testing	B1
9(b)(iii)	440 – 24 or 416 or 52 or 55 or 79 or 3 (half-lives) or 45/15 or $1/2^3$ or 1/8 $1/2^3$ or 1/8 or 52 or 55 or 79 76 (counts)	C1 C1 A1

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

May/June 2019

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	C	1
2	C	1
3	D	1
4	C	1
5	C	1
6	D	1
7	D	1
8	C	1
9	C	1
10	B	1
11	C	1
12	A	1
13	C	1
14	A	1
15	A	1
16	B	1
17	D	1
18	B	1
19	B	1
20	C	1
21	B	1
22	D	1
23	D	1
24	B	1
25	A	1
26	D	1
27	D	1
28	B	1

Question	Answer	Marks
29	C	1
30	B	1
31	B	1
32	A	1
33	B	1
34	C	1
35	D	1
36	C	1
37	D	1
38	C	1
39	B	1
40	B	1

PHYSICS

0625/41

Paper 4 Extended Theory

May/June 2019

MARK SCHEME

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GENERIC MARKING PRINCIPLE 6:

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Question	Answer	Marks
1(a)	change of velocity per unit time OR $\frac{v-u}{t}$	B1
1(b)	line starts at origin and is asymptotic to x-axis	B1
	increasing gradient initially and no decrease	B1
	constant and clearly positive gradient finally	B1
1(c)(i)	no external forces OR isolated system	B1
	sum of momenta / (total) momentum remains constant	B1
1(c)(ii)	rocket <u>gains</u> (upward) momentum	B1
	(ejected) gas <u>gains</u> equal (quantity of) momentum in opposite direction OR momentum of gas <u>decreases</u> by equal amount	B1

Question	Answer	Marks
2(a)	$(W =) mg$ OR $3.4 \times 10^3 \times 10$	C1
	$3.4 \times 10^4 \text{ N}$	A1
2(b)(i)	moment = Fx in any form OR (moment) = Fx OR 0.50 (seen)	C1
	$3.4 \times 10^4 \times (1.8 - 1.3)$ OR $3.4 \times 10^4 \times 0.50$	C1
	$1.7 \times 10^4 \text{ N m}$	A1
2(b)(ii)	1. (the point) where (all) the mass can be considered to be concentrated	B1
	2. $1.7 \times 10^4 / (1.3 + 0.70)$ OR $1.7 \times 10^4 / (2.0)$	C1
	$8.5 \times 10^3 \text{ N}$	A1
2(c)	(moment / it) increases	B1
	perpendicular distance (between P and line of action of) W increases	B1

Question	Answer	Marks
3(a)	(air) molecules / they move / collide	B1
	(air) molecules / they collide with cube / (upper) surface (of cube) / wall	B1
	impulse exerted (on surface) OR momentum change (of molecules)	B1
3(b)(i)	$p = h\rho g$ in any form OR $(p =) h\rho g$ OR $0.028 \times 1500 \times 10$	C1
	420 Pa	A1
3(b)(ii)	$F = pA$ in any form words, symbols or numbers OR $(F =) pA$ OR 420×4.0^2 OR 420×0.040^2 OR 420×16 OR $420 \times 1.6 \times 10^{-3}$	C1
	0.67 N	A1
3(c)(i)	$W = Fd$ in any form words, symbols or numbers OR $(W =) Fd$ OR 0.67×0.034	C1
	0.023	A1
3(c)(ii)	lifting liquid as well OR friction between liquid and container / pipe	B1

Question	Answer	Marks
4(a)(i)	$E = mc (\Delta)T$ in any form words, symbols or numbers OR $(E =) mc (\Delta)T$ OR $0.23 \times 0.72 \times 550$	C1
	91 J	A1
4(a)(ii)	1. $t = E / P$ in any form words, symbols or numbers OR $(t =) E / P$ or $91 / 2.4$	C1
	38 s	A1
	2. (thermal) energy is used to increase the temperature of / lost to cylinder / piston / heater / surroundings	B1
4(b)(i)	it / piston moves to the <u>right</u> / <u>away from heater</u> OR <u>accelerates</u> (to right)	M1
	pressure (of gas) greater / pressure greater (on left) / <u>resultant force to right</u>	A1
4(b)(ii)	$V_2 = p_1 V_1 / p_2$ in any form OR $(V_2 =) p_1 V_1 / p_2$ OR $2.9 \times 10^5 \times 1.9 \times 10^{-4} / 1.0 \times 10^5$	C1
	$5.5 \times 10^{-4} \text{ m}^3$	A1

Question	Answer	Marks
5(a)(i)	<p>any two from:</p> <p>occurs throughout the liquid OR bubbles formed occurs at one temperature / boiling point does not produce cooling OR unaffected by draught / surface area / humidity</p>	B2
5(a)(ii)	(more) energetic molecules escape (from the liquid) OR molecules gain energy and escape OR molecules overcome intermolecular forces / break bonds	B1
	average speed decreases OR molecules with less (kinetic) energy left behind	B1
	temperature of liquid decreases	B1
	(thermal) energy conducted / gained from skin / body OR (thermal) energy lost by skin / body	B1
5(b)	molecules touching OR no space between molecules	B1
	large (repulsive / intermolecular) forces (when moved closer)	B1

Question	Answer	Marks
6(a)	idea of one side of wavefront enters / hits solid first OR wavefront does not all hit the solid all at once;	B1
	idea of this side slowed down first OR this side delayed relative to other side	B1
	angle of wave(front) changes OR different parts of wavefront delayed by different amounts	B1
6(b)(i)	$n = \frac{\sin i}{\sin r}$ in any form OR $n_1 \sin \theta_1 = n_2 \sin \theta_2$ OR $1.3 = \frac{\sin 67^\circ}{\sin r}$ OR ($r = \sin^{-1}(\sin 67^\circ / 1.3)$) OR $\sin^{-1}(0.71)$	C1
	45°	A1
6(b)(ii)	$v_{ts} = c / n$ in any form OR ($v_{ts} = c / n$) OR $3.0 \times 10^8 / 1.3$	C1
	2.3×10^8 OR $3.0 \times 10^8 / 1.3$	C1
	$\lambda = v / f$ in any form OR ($\lambda = v / f$) OR $2.3 \times 10^8 / 5.7 \times 10^{14}$ OR $3.0 \times 10^8 / (1.3 \times 5.7 \times 10^{14})$	C1
	$4.0 \times 10^{-7} \text{ m}$	A1
	OR (alternative approach)	
	$\lambda = v / f$ in any form OR ($\lambda = v / f$) OR $3.0 \times 10^8 / 5.7 \times 10^{14}$	C1
	5.3×10^{-7} OR $3.0 \times 10^8 / 5.7 \times 10^{14}$	C1
	$\lambda_g = \lambda_a / n$ in any form OR ($\lambda_g = \lambda_a / n$) OR $5.3 \times 10^{-7} / 1.3$ OR $3.0 \times 10^8 / (1.3 \times 5.7 \times 10^{14})$	C1
	$4.0 \times 10^{-7} \text{ m}$	A1

Question	Answer	Marks
7(a)	thermistor c.a.o.	B1
7(b)(i)	$V_X = V_{30}$	B1
7(b)(ii)	$V_X = E - V_{20}$ in any form	B1
7(c)(i)	$1/R_1 + 1/R_2 = 1/R_{\text{tot}}$ OR $(R_{\text{tot}} =) R_1 R_2 / (R_1 + R_2)$ OR $1/15 + 1/30 = 1/R_{\text{tot}}$ OR $(15 \times 30) / (15 + 30)$	C1
	10 (Ω) OR 10 + 20	C1
	30 Ω	A1
7(c)(ii)	$I = V / R$ in any form OR $(I =) V / R$ OR 6.0 / 30	C1
	0.20 A	A1
7(d)	resistance <u>of X</u> decreases	B1
	ammeter reading / it increases and (total) resistance (of circuit) decreases / more voltage across 20 Ω resistor	B1

Question	Answer			Marks
8(a)(i)	<u>magnetic</u> field mentioned			B1
	coil / wire cuts (magnetic) field OR changing (magnetic) field (through coil)			B1
	e.m.f. / voltage <u>induced</u> OR produced by electromagnetic <u>induction</u>			B1
8(a)(ii)	(plane of coil) horizontal OR in position shown in diagram coil cutting magnetic field the fastest			B1 B1
8(b)	current in coil	OR	energy supplied to / lost from lamp	B1
	current in (magnetic) field experiences a force		student must do more work / supply more energy / more energy needed	B1
	opposes the change causing it		greater force to do more work	B1

Question	Answer	Marks
9(a)(i)	mark both explanation and deduction together	
	nucleus is very small	B1
	very few α -particles hit or pass near to a nucleus	B1
9(a)(ii)	mark both explanation and deduction together	
	<u>nucleus is charged</u>	B1
	(charged) α -particles experience a force	B1
9(a)(iii)	mark both explanation and deduction together	
	centre / (small) part of atom OR nucleus includes most of the mass of the atom / is (very) dense	B1
	(α -particles move and) nucleus stays still	B1
9(b)	any two from: opposite direction (much) smaller deflection undergo deflections of similar magnitude	B2

PHYSICS

0625/21

Paper 2 Multiple Core

October/November 2018

MARK SCHEME

Maximum Mark: 40

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This document consists of 3 printed pages.

Question	Answer	Marks
1	B	1
2	C	1
3	B	1
4	D	1
5	C	1
6	D	1
7	A	1
8	D	1
9	C	1
10	B	1
11	C	1
12	A	1
13	A	1
14	A	1
15	D	1
16	A	1
17	A	1
18	C	1
19	B	1
20	B	1
21	C	1
22	D	1
23	B	1
24	B	1
25	C	1
26	B	1
27	B	1
28	A	1

Question	Answer	Marks
29	C	1
30	D	1
31	A	1
32	D	1
33	C	1
34	A	1
35	C	1
36	A	1
37	B	1
38	A	1
39	B	1
40	A	1

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2018

MARK SCHEME

Maximum Mark: 80

Published

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.

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These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

B marks	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it . For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
Brackets ()	Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
<u>Underlining</u>	Underlining indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
e.e.o.o.	This means "each error or omission".
o.w.t.t.e.	This means "or words to that effect".
Ignore	This indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.
Not/NOT	This indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but only applies to marks annotated ecf.
Significant	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question . No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Unless listed here or stated in the mark scheme for the question, do not accept derived units e.g. kg m/s^2 for N is NOT acceptable. The following are acceptable alternatives: N m for J, J/s or N m/s for W, N/m ² for Pa, N s and kg m/s are both acceptable for momentum and impulse. Beware: J is NOT acceptable for moments. Condone wrong use of upper and lower case symbols e.g. pA for Pa. Annotate with U. For more than one unit error in a question, underline with a wavy line to indicate an error which has not been penalised.
Arithmetic errors	Deduct one mark if the only error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.
Fractions	Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out and not replaced but can easily be read , should be marked as if it had not been crossed out.
Use of NR	Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks
1(a)(i)1	($4800 / 120 =$) 40 m / s	B1
1(a)(i)2	($v =$) gradient of any part of straight line	C1
	Value between 50 and 60 m / s	A1
1(a)(ii)	At $t = 20$ s, acceleration > zero / acceleration is taking place / greater acceleration than at 100 s	B1
	At $t = 100$ s, acceleration = zero / 0	B1
1(b)(i)	($F =$) ma OR $5.6 \times 10^5 \times 0.75$	C1
	4.2×10^5 N	A1
1(b)(ii)	Speed / velocity decreases (with time) OR slowing down OR negative acceleration OR Rate of decrease of speed / velocity	B1

Question	Answer	Marks
2(a)	$P \times 1.5$	B1
2(b)(i)	($W \times 1.0$ OR $210 \times 1.0 =$) 210 N m	B1
2(b)(ii)	$P \times 1.5 = 210$ OR $P = 210 / 1.5$	C1
	140 N	A1
2(b)(iii)	$P + Q = 210$ OR $140 + Q = 210$ OR $Q \times 1.5 = 210 \times 0.5$ OR $Q = 210 \times 0.5 / 1.5$ OR $P \times 0.5 = Q$	C1
	$Q = 70$ N	A1

Question	Answer	Marks
3(a)	Energy cannot be created or destroyed OR energy can only be transferred from one form to another OR total energy remains constant	B1
3(b)(i)	Chemical (energy) to kinetic (energy) AND / OR potential (energy) Any one of: Kinetic (energy) to potential (energy) OR gravitational (energy) Potential (energy) OR gravitational (energy) to kinetic (energy) Kinetic (energy) to thermal (energy) OR heat (energy)	B1
3(b)(ii)1	(momentum =) mv OR 4.0×12	C1
	48 kg m/s or N s	A1
3(b)(ii)2	(average force =) momentum change / time OR $m(v - u)/t$ OR $(mv - mu)/t$ OR $F = ma$ AND $a = (v - u)/t$ OR $48/0.60$	C1
	80 N	A1

Question	Answer	Marks
4(a)	mass = 0.25 (kg) OR $\rho = m/V$	C1
	volume = $(\pi \times 0.03^2 \times 0.1 = 2.8 \times 10^{-4} (\text{m}^3))$	C1
	density = $(0.25 / 2.8 \times 10^{-4}) = 890 \text{ kg/m}^3$	A1
	OR	
	mass = 250 (g) OR $\rho = m/V$	
	volume = $(\pi \times 3^2 \times 10 =) 280 \text{ cm}^3$	
	density = $(250 / 280 =) 0.89 \text{ g/cm}^3$	
	OR	
	$\rho = F/A = hpg$	
	$\rho = F/Ahg$ OR $2.5 / \pi \times 0.03^2 \times 0.1 \times 10$	
	= 890 kg/m ³	
4(b)(i)	manometer	B1
4(b)(ii)	$(P =) hdg$ OR $0.02 \times 800 \times 10$	C1
	160 Pa	A1
4(b)(iii)	Value of h stays the same	M1
	Difference in height not dependent on cross-sectional area of tube OR Pressure of a liquid column depends only on values of h , d and g	A1

Question	Answer	Marks
5(a)(i)	2 different metals labelled	B1
	2 junctions between different metals	B1
	Correctly connected meter	B1
5(a)(ii)	Any two of: Suitable for high temp measurement OR has wide range Has low value of thermal capacity OR absorbs only a small quantity of thermal energy / heat Measures temperature at a point OR small size Responds quickly Can be used for remote sensing	B2
5(b)(i)	More sensitive	B1
	Thread moves <u>further</u> (for same expansion)	B1
5(b)(ii)	More sensitive	B1
	Greater expansion / more liquid (from bulb)	B1

Question	Answer	Marks
6(a)	<p>Any three from:</p> <p>Temperature (of liquid / water) Surface area (of liquid / water) Draught / wind / movement of air (over surface) Temperature <u>of surroundings</u> Humidity (of surrounding air)</p>	B3
6(b)	<p>Any two from:</p> <p>More energetic / faster molecules escape Less energetic / slower molecules remain OR remaining water is colder Thermal energy / heat flows from body / skin to colder water (and person feels colder)</p> <p>OR (for one mark each)</p> <p>(Evaporation requires) latent heat of vaporisation Thermal energy / heat flows from body / skin</p>	B2

Question	Answer	Marks
7(a)	Light of a single colour / wavelength / frequency	B1
7(b)(i)	Reflected wavefronts:	
	In air, at least 3 wavefronts parallel to each other.	B1
	Same spacing as incident wavefronts	B1
	Reflecting at same angle with surface as incident wavefronts	B1
7(b)(ii)	Refracted wavefronts:	
	In glass, at least 3 wavefronts parallel to each other AND continuous with incident wavefronts, unless drawn to right of incident wavefronts.	B1
	Smaller wavelength than incident wavefronts AND equally spaced.	B1
	At smaller angle with surface than incident wavefronts and rotated clockwise compared to incident wavefronts	B1
7(c)	Rope drawn with two of: Amplitude labelled Wavelength labelled Crest and trough labelled	B2

Question	Answer	Marks
8(a)	Particles / molecules / water / medium vibrate	B1
	Vibration is in the direction travel of the wave	B1
	Has compressions and rarefactions	B1
8(b)(i)	Value in range from 900 m / s to 2000 m / s	B1
8(b)(ii)	$v = f\lambda$ in any form OR $(\lambda =) v/f$ OR answer to (b)(i) / 800	C1
	correct evaluation with unit (m)	A1

Question	Answer	Marks
9(a)	2 lamps with correct circuit symbol, in parallel, with correct connection to battery	B1
9(b)(i)	$(12 / 6.0 =) 2.0 \text{ A}$	B1
9(b)(ii)	$(P =) IV$ OR 2.0×12	C1
	OR $(P =) I^2R$ OR $2.0^2 \times 6.0$	(C1)
	OR $(P =) V^2/R$ OR $12^2 / 6.0$	(C1)
	24 W	A1
9(c)	$(E =) IVt$ OR Pt in any form OR 36×20	C1
	$= 36 \times 20 \times 60 \times 60$	C1
	$= 2.6 \times 10^6 \text{ J}$	A1

Question	Answer	Marks
10(a)	(soft) iron	B1
10(b)(i)	Alternating / changing magnetic field in primary (coil)	B1
	Alternating / changing (magnetic) field in core (and in secondary coil) OR (magnetic) field lines / flux link secondary	B1
	e.m.f / voltage <u>induced</u> (in secondary coil)	B1
10(b)(ii)	$V_P / V_S = N_P / N_S$ in any form OR ($V_P = V_S \times N_P / N_S$) OR $78 \times 560 / 910$	C1
	48 V	A1
10(c)	Lower current	B1
	(Power loss from cables =) I^2R so lower current means less power loss OR less heat loss	B1

Question	Answer	Marks
11(a)	$\frac{14}{6}$ C on left-hand side	B1
	$\frac{14}{7}$ on right-hand side (ignoring letter after or before $\frac{14}{7}$)	B1
	N after $\frac{14}{7}$ on right-hand side	B1
	$+ \frac{0}{-1}$ e on right-hand side OR $- \frac{0}{-1}$ e on left-hand side	B1
11(b)	Not α because count-rate with paper increase	B1
	Not β because count-rate with aluminium increase	B1
	is γ because count rate reduces with lead only OR does not reduce with paper or aluminium	B1

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

May/June 2018

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	A	1
2	C	1
3	D	1
4	B	1
5	A	1
6	A	1
7	B	1
8	B	1
9	C	1
10	C	1
11	C	1
12	C	1
13	D	1
14	D	1
15	B	1
16	B	1
17	C	1
18	B	1
19	D	1
20	B	1
21	A	1
22	D	1
23	A	1
24	D	1
25	C	1
26	B	1
27	C	1
28	C	1

Question	Answer	Marks
29	D	1
30	B	1
31	D	1
32	B	1
33	B	1
34	C	1
35	A	1
36	A	1
37	D	1
38	D	1
39	C	1
40	A	1

PHYSICS

0625/41

Paper 4 Extended Theory

May/June 2018

MARK SCHEME

Maximum Mark: 80

Published

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GENERIC MARKING PRINCIPLE 1:

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- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	Mention of gradient of graph at $t = 30\text{ s}$ OR tangent drawn at $t = 30\text{ s}$ and triangle drawn	1
	Acceleration in range 0.30 to 0.45 m/s^2	1
1(b)	Acceleration less/at a slower rate	1
	Less driving force OR greater resistive force/friction/air resistance/drag	1
	Resultant force less	1
1(c)	Area under graph	1
	$\text{Distance} = (20 \times 40) + (\frac{1}{2} \times 40 \times 10)$ OR $\frac{1}{2} \times (30 + 20) \times 40$	1
	1000 m	1

Question	Answer	Marks
2(a)	Chemical (potential energy)	1
2(b)(i)	$(E =) m \times g \times h$ OR $32 \times 10 \times 2.5$	1
	800 J	1
2(b)(ii)	$\text{Output power} = E \div t$ OR $800 \div 5.4$ OR 148.148 (W)	1
	$\text{Eff.} = \text{output (power)} \div \text{input (power)}$ OR $P_{\text{out}} \div P_{\text{in}}$ OR $E_{\text{out}} \div E_{\text{in}}$ OR output power $\div 0.65$ OR $148.148 \div 0.65$ OR $800 \div 0.65$	1
	= 230 W	1
2(c)	Advantage: not dependent on weather/wind blowing OR always available	1
	Disadvantage: polluting OR CO_2/SO_2 /greenhouse gases emitted OR leads to global warming OR oil must be transported OR not renewable OR oil will run out/be used up	1

Question	Answer	Marks
3(a)(i)	$W = (4.8 \times 10) = 48 \text{ N}$	1
3(a)(ii)	$(P =) F \div A$ OR $48 \div (0.12 \times 0.16)$	1
	2500 Pa	1
3(b)	Atmospheric pressure (in addition to liquid pressure)	1
3(c)	$P = hdg$ or in words OR $(d =) P \div hg$ OR $2500 \div (0.32 \times 10)$	1
	780 kg / m ³	1
	OR $d = M \div V = 4.8 \div (0.12 \times 0.16 \times 0.32)$	(1)
	780 kg / m ³	(1)

Question	Answer	Marks
4(a)(i)	(Molecules) vibrate	1
4(a)(ii)	random/haphazard/in all directions	1
	Any one of: with high speed freely zig-zag in straight lines	1
4(b)	(Molecules) collide with walls (of box) OR (Molecules) rebound from walls (of box)	1
	Change of momentum (occurs)	1
	force (on walls) = (total) change of momentum per second	1
	Pressure = (total) force ÷ (total) area (of walls)	1

Question	Answer	Marks
5(a)(i)	Refraction OR reflection	1
5(a)(ii)	If refraction in (i) Change or increase or decrease in speed of wave OR change of refractive index OR	1
	If reflection in (i) Mention of surface or boundary	(1)
5(b)(i)	2 points both labelled F at 3.5 cm either side of optical centre of lens	1
5(b)(ii)	Any two of: Paraxial ray from tip of O refracted through farther F/3.5 cm Undeviated ray from tip of O through optical centre of lens Ray from tip of O through nearer F refracted paraxially	2
	Image/I drawn from intersection of rays to principal axis with indication that image is inverted	1
5(b)(iii)	In range 3.6 to 4.1 cm	1
5(b)(iv)	(Image is) real and light passes through it OR can be projected/seen on a screen OR refracted rays cross/meet	1

Question	Answer	Marks
6(a)(i)	At least 3 circular wavefronts centred on gap extending to at least half of semicircle	1
	Same spacing as incident wavefronts	1
6(a)(ii)	At least 3 straight, parallel, wavefronts, approximately same length as width of gap	1
	Ends of straight lines curving towards but not reaching barrier	1
6(b)	Any four of: Diagram to show: labelled barrier, incident straight or curved waves Diagram shows appropriately reflected waves Water surface e.g. tank of water/ripple tank/pond/acceptable alternative How waves are produced: e.g., moving end or length of solid rod dipping into surface OR small solid object thrown in. Detail of barrier: made of metal, glass or wood fixed in position How observed: by eye, video, film, stroboscope	4

Question	Answer	Marks
7(a)	(Metals) contain free/mobile electrons/delocalised electrons	1
7(b)(i)	$R \propto L$ and $R \propto 1 \div A$ OR $R \propto L \div A$ OR $R = 16 \times \frac{1}{2} \div 2$ OR $R = 16 \div 4$	1
	4.0Ω	1
7(b)(ii)	$1 \div R = (1 \div R_1) + (1 \div R_2)$ OR $R = (R_1 \times R_2) \div (R_1 + R_2)$ OR $(1 \div R) = (1 \div 4) + (1 \div 16)$ OR $(4 \times 16) \div (4 + 16)$	1
	3.2Ω	1
7(c)(i)	$3E$ or $3 \times E$	1
7(c)(ii)	$I_B > I_2 > I_1$ (6th box ticked)	1

Question	Answer	Marks
8(a)	(Q =) $mc\Delta\theta$ OR $200 \times 4.2 \times 22$	1
	18000 J	1
8(b)	$Q = m \times L$ OR ($L =$) $Q \div m$ OR $18480 \div 60$	1
	310 J/g	1
8(c)	(Thermal) energy/heat transfers from surroundings OR into water	1

Question	Answer	Marks
9(a)	Would not be effective OR No	1
	With current on OR the (alternating) current should not be switched off	1
	Magnet should be withdrawn from the coil	1
	OR Magnet would be alternately magnetised in different directions	(1)
	Would remain magnetised in the direction occurring at the moment of switching off	(1)
9(b)(i)	Coil turns	1
	Clockwise/continuously	1
	Current (in coil) reverses every half turn/when coil is in vertical position OR force on current in a magnetic field	1
9(b)(ii)	1 \times $(4 \times T)$	1
	2 \times $(2 \times T)$	1
	3 \times $(T \div 2)$	1

Question	Answer	Marks
10(a)	To produce an alternating/changing magnetic field	1
	so that current/voltage is <u>induced</u> (continuously) in the <u>secondary</u> coil OR <u>secondary</u> circuit	1
10(b)(i)	$N_s \div N_p = V_s \div V_p$ in any form OR $(N_s =) N_p \times V_s \div V_p$ OR $8000 \times 6 \div 240$	1
	200	1
10(b)(ii)	$I_p V_p = I_s V_s$ in any form OR $(I_p =) I_s \times V_s \div V_p$ OR $2.0 \times 6 \div 240$	1
	0.050 A	1
10(b)(iii)	(Number of lamps =) $2 \div 0.05 = 40$	1

Question	Answer	Marks
11(a)	Number of protons = 86 and number of electrons = 86	1
	Number of neutrons = 136	1
11(b)	$^{218}_{84} \text{Po}$	1
	${}_{2}^{4} \alpha$	1
11(c)	7.6 days = 2 half-lives or evidence of two halvings	1
	(number of Rn atoms left = $6.4 \times 10^6 \div 4 =$) 1.6×10^6	1
	number of α -particles emitted = $(6.4 \times 10^6 - 1.6 \times 10^6 =) 4.8 \times 10^6$	1

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

October/November 2017

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
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2	A	1
3	A	1
4	D	1
5	B	1
6	C	1
7	B	1
8	C	1
9	D	1
10	D	1
11	B	1
12	B	1
13	B	1
14	A	1
15	A	1
16	D	1
17	A	1
18	C	1
19	A	1
20	C	1
21	A	1
22	C	1
23	D	1
24	D	1
25	A	1
26	B	1
27	B	1
28	C	1

Question	Answer	Marks
29	C	1
30	A	1
31	C	1
32	B	1
33	B	1
34	B	1
35	A	1
36	D	1
37	C	1
38	A	1
39	B	1
40	A	1

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2017

MARK SCHEME

Maximum Mark: 80

Published

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**Cambridge Assessment
International Education**

Question	Answer	Marks
1(a)(i)	Distance = area under graph OR $0.5 \times 20 \times 13$	C1
	130 m	A1
1(a)(ii)	$(a =) (v - u) / t$ OR $(a =) v / t$ OR $13 / 20$	C1
	0.65 m/s^2	A1
1(a)(iii)	$(F =) ma$ OR 1200×0.65	C1
	= 780 N	A1
1(b)	Acceleration decreases OR rate of increase of speed decreases OR speed increases at a lower rate	B1

Question	Answer	Marks
2(a)	Extension of a spring is (directly) proportional to load / force / weight OR $F = ke$ where e is extension	B1
2(b)(i)	<u>Straight</u> line drawn from origin to (64 mm, 120 N)	B1
2(b)(ii)	$F = ke$ in any form OR $120 / 64$ OR $120 / 6.4$ OR $120 / 0.064$	C1
	c.a.o. 1.9 N/mm OR 19 N/cm OR 1900 N/m	A1
2(c)	Above 120 N / at 140 N, the spring does not obey Hooke's law OR the extension is not proportional to the load / weight / force	B1
	The elastic limit / limit of proportionality of the spring has been exceeded	B1

Question	Answer	Marks
3(a)	(Measure of) quantity / amount of matter OR (property) that resists change in motion / speed / momentum OR measure of a body's inertia	B1
3(b)(i)	$d = m/V$ OR in words OR $0.44/0.080^3$ OR $0.44/5.12 \times 10^{-4}$ OR $440/8^3$ OR $440/512$ OR $0.44/8^3$ OR $0.44/512$ 0.86 g/cm^3 OR 860 kg/m^3 OR $8.6 \times 10^{-4} \text{ kg/cm}^3$	C1
3(b)(ii)	Sinks OR does not float AND (cube) denser (than oil)	B1
3(c)(i)	$W = mg$ OR ($g =$) W/m OR $0.70/0.44$ 1.6 N/kg	C1
3(c)(ii)	$(P =) hdg$ OR $0.030 \times 850 \times 1.6$ 41 Pa	C1

Question	Answer	Marks
4(a)	Atoms collide with wall (and rebound) OR atoms rebound from wall (Atoms) undergo change of momentum	B1 C1
	Force on wall = (total) rate of change of momentum (of atoms) OR = change of momentum (of atoms) per second OR = change of momentum (of atoms) / time	A1
4(b)(i)	Fewer atoms per unit volume OR density of gas less	B1
	Rate of collision (with walls of balloon) decreases OR Fewer collisions per unit area	B1
4(b)(ii)	$PV = \text{constant}$ OR $P_1V_2 = P_2V_2$ OR ($P_2 =$) P_1V_1/V_2 OR $1.0 \times 10^5 \times 9.6/12$ $8.0 \times 10^4 \text{ Pa}$	C1 A1

Question	Answer	Marks
5(a)	Tick 2nd box only	B1
5(b)(i)	At least 3 parallel wavefronts in shallow water sloping upwards from left to right	B1
	Wavefronts in shallow water meet wavefronts in deep water	B1
5(b)(ii)	Indication that frequency is same in deep and shallow water	C1
	In deep water $v = f\lambda$ in any form OR ($f = v/\lambda$) OR $80 / 1.4$	C1
	= 57.1 (Hz)	C1
	Wavelength in shallow water = v/f OR $60 / 57.1 = 1.05$ cm	A1
	OR	
	speed in deep water / speed in shallow water = $0.80 / 0.60$	(C1)
	= 1.33	(C1)
	(f is constant so) λ in deep water / λ in shallow water = 1.33	(C1)
	λ in shallow water = $1.4 / 1.33 = 1.05$ cm	(A1)

Question	Answer	Marks
6(a)	1500 m / s liquid 5000 m / s solid 300 m / s gas	B2
6(b)(i)	X and Y marked at centres of any two rarefactions	B1
6(b)(ii)	Area of low pressure or low density (of atoms) or where atoms / molecules far apart	B1
6(c)	$v = d/t$ or $2d/t$ in any form	C1
	$d = vt/2$ OR $3.0 \times 10^8 \times 2.56 / 2$	C1
	$3.84 \times 10^8 \text{ m}$ OR $3.84 \times 10^5 \text{ km}$	A1

Question	Answer	Marks
7(a)	One ray with correct path through lens	B1
	Another ray with correct path through lens Rays intersect to right of F and below axis, inverted image	B1
	drawn <u>and</u> labelled I	B1
7(b)	enlarged, upright and virtual <u>only</u> underlined or ringed	B2
	Two of above descriptions underlined	B1
7(c)	On entering prism: green ray deflection more than red ray and above normal	B1
	On leaving prism: diverging downwards from red ray and not along surface of prism	B1

Question	Answer	Marks
8 Hydroelectric		
8(a)	Hydroelectric named OR water from behind dam	B1
	K.E. of (falling) water used / P.E. of stored water	B1
	Turbine / waterwheel / paddle wheel operated	B1
	(Turbine) turns / drives a generator (that produces electricity)	B1
8(b)	Rain (fills lakes in high places)	B1
	Cause of rain is the Sun, so renewable	B1
8(c)	Sun evaporates water from sea etc. to fall (later) as rain	B1
	Sun is the source of energy.	B1
8 Tidal flow		
8(a)	Tides / tidal flow named	B1
	K.E. of water used	B1
	Turbine / waterwheel / paddle wheel operated	B1
	(Turbine) turns / drives a generator (that produces electricity)	B1
8(b)	Moon (and Sun) causes tides	B1
	Moon (and Sun) permanently in place, so renewable	B1
8(c)	Attraction due to Moon's (and Sun's) gravity causes tides	B1
	Sun is a source of (part of) the energy OR Sun is not the primary source of energy	B1

Question	Answer	Marks
8 Waves		
8(a)	Waves on surface of sea	B1
	K.E. of water used to oscillate a floating mechanism	B1
	Turbine / waterwheel / paddle wheel operated	B1
	(Turbine) turns / drives a generator (that produces electricity)	B1
8(b)	Wind causes waves	B1
	Sun causes wind, so renewable	B1
8(c)	Winds are air currents caused by thermal energy / heat from the Sun	B1
	Sun is the source of energy	B1

Question	Answer	Marks
9(a)(i)	($3 \times 1.5 =$) 4.5 V	B1
9(a)(ii)	$1/R = 1/R_1 + 1/R_2$ OR $R = 1/(1/R_1 + 1/R_2)$ OR ($R = R_1R_2/(R_1 + R_2)$)	C1
	Correct substitution of 3 and 6	C1
	($R =$) 2.0 Ω	A1
9(a)(iii)	$V = IR$ in any form OR ($I = V/R$) OR 4.5 / 3	C1
	1.5 A	A1
	OR	
	$I_{\text{total}} = 4.5 / 2 = 2.25 \text{ A}$	(C1)
	For 3 Ω , $I = 2.25 \times 6 / 9 = 1.5 \text{ A}$	(A1)
9(b)(i)	Connect ammeter (in wire) from A to B OR from H to G	B1
9(b)(ii)	Connect voltmeter (terminals) to A and H OR B and G OR C and D OR E and F	B1

Question	Answer	Marks
10(a)(i)		B1
10(a)(ii)	To allow flow (of current) in one direction	B1
10(b)(i)	Wire from B to + or – terminal of battery and wire from A to other terminal of battery	B1
	Diode to allow current in at + terminal or out at – terminal	B1
10(b)(ii)	Alternating current in coil Y sets up alternating magnetic field OR causes change in magnetic flux	B1
	Alternating field / change in flux cuts coil X OR Alternating field links with coil X	B1
	(Alternating) voltage / current is <u>induced</u> in coil X OR (Alternating) voltage / current is produced in coil X by electromagnetic induction	B1

Question	Answer	Marks
11(a)(i)	An electron	M1
	In / from / by the nucleus	A1
11(a)(ii)	Proton numbers balance on left and right sides of equation	B1
	Nucleons numbers balance on left and right sides of equation	B1
	${}^0_{-1}\beta$	B1
11(b)	Time for activity / count rate / number of nuclei / number of atoms to halve	B1
11(c)(i)	α -particles would be stopped / absorbed by <u>the plastic / bottle</u>	B1
11(c)(ii)	γ -rays would not be absorbed by the liquid / bottle OR reading not reduced (in passing through liquid / bottle) OR very penetrative so no change in detector reading	B1

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

May/June 2017

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Marks
1	A	1
2	B	1
3	B	1
4	C	1
5	C	1
6	D	1
7	C	1
8	B	1
9	A	1
10	A	1
11	C	1
12	C	1
13	C	1
14	A	1
15	B	1
16	D	1
17	C	1
18	D	1
19	B	1
20	D	1
21	D	1
22	A	1
23	A	1
24	D	1
25	A	1
26	C	1
27	C	1
28	A	1

Question	Answer	Marks
29	D	1
30	C	1
31	B	1
32	B	1
33	C	1
34	D	1
35	C	1
36	D	1
37	B	1
38	B	1
39	A	1
40	B	1

PHYSICS

0625/41

Paper 4 Extended Theory

May/June 2017

MARK SCHEME

Maximum Mark: 80

Published

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Question	Answer	Marks
1(a)	decrease of velocity / speed OR slows / slowing down	B1
1(b)(i)	Area under graph OR $\frac{1}{2}(u+v)t$ OR $\frac{1}{2} \times (11 + 5) \times 3$ OR $\frac{1}{2}(6 \times 3)$ OR (3×5)	C1
	24 m	A1
1(b)(ii)	$(a =) \Delta v / \Delta t$ OR $(v - u) / t$ OR $(5 - 11) / (6 - 3)$	C1
	2.0 m/s ²	A1
1(c)(i)	(deceleration) decreases	B1
1(c)(ii)	(Resultant force) decreases	B1
	Total:	7

Question	Answer	Marks
2(a)(i)	Ft OR 180×0.050	C1
	9.0 Ns OR 9.0 kg m/s	A1
2(a)(ii)	$Ft = m(v - u)$ OR $Ft = mv - mu$ OR $Ft = mv$ OR ($m =$) Ft/v OR 9.0/20	C1
	0.45 kg	A1
2(a)(iii)	$mgh = \frac{1}{2}mv^2$ OR ($h =$) $v^2/2g$	C1
	($h =$) $20^2/(2 \times 10)$	C1
	20 m	A1
	OR $t = v/g = 2$	(C1)
	$h = \text{average speed} \times \text{time}$	(C1)
	20 m	(A1)
2(b)	Elastic (energy) OR strain (energy)	B1
	Total:	8

Question	Answer	Marks
3(a)(i)	(Weight is) force/pull of gravity (acting on an object)	B1
3(a)(ii)	Mass × acceleration due to gravity OR mg OR 350×7.5	C1
	2600 N	A1
3(b)	$(\rho =) m/V$ in any form	C1
	0.27 (kg/m^3) OR 270 (g/m^3)	A1
	Balloon moves/floats <u>up</u>	B1
	(Floats when) density of balloon less than density of atmosphere OR (sinks when) density of balloon greater than atmosphere	B1
	OR $(\rho =) m/V$ in any form	(C1)
	110 g	(A1)
	Balloon rises	(B1)
	(Floats when) mass/weight of balloon less than mass/weight of atmosphere (of same volume as balloon) (Sinks when) mass/weight of balloon greater than mass/weight of atmosphere (of same volume as balloon)	(B1)
	Total:	7

Question	Answer	Marks
4(a)(i)	60 W	B1
4(a)(ii)	<u>Radiation</u> and either conduction or convection	B1
4(b)(i)	Radiation mentioned	B1
	Higher reading or rises faster on thermometer A	B1
	Black (surface) is a good/better emitter (than polished surface) OR polished (surface) is a poor/bad/worse emitter (than black surface)	B1
4(b)(ii)	(Compared with black bulb thermometer) readings rise more slowly OR readings are low(er)	B1
	Shiny (bulb) surfaces are good/better reflectors (of radiation) OR Shiny (bulb) surfaces are poor/bad/worse absorbers (of radiation)	B1
4(c)	Firefighter does not get too hot/burned (from radiation)	B1
	Total:	8

Question	Answer	Marks
5(a)	Pressure increases	B1
	Molecules (of gas) move faster/their <u>kinetic</u> energy increases/their momentum increases	B1
	(Molecules) collide with walls/piston more often/more frequently OR greater (rate of) change of momentum	B1
	(Molecules) exert greater/more force (on wall)/hit (walls) <u>harder</u>	B1
5(b)	Pressure (of gas) falls and volume (of gas) increases	B1
	Initially there is a larger pressure inside than outside/atmospheric pressure OR (Piston stops when) pressure (of gas) = external/outside/atmospheric pressure	B1
	Total:	6

Question	Answer	Marks
6(a)(i)	(Ray passes into the air and) refracts / changes direction / bends	B1
6(a)(ii)	Total internal reflection (takes place)	B1
6(b)(i)	Total internal reflection at B with angle of incidence equal to angle of reflection (by eye)	B1
	Refraction into air at right-hand face with angle of refraction greater than angle of incidence	B1
6(b)(ii)	($n =$) $1/\sin c$ OR $1/\sin 41$	M1
	1.5	A1
	Total:	6

Question	Answer	Marks
7(a)	Number of wavefronts (generated/produced/passing a point) in 1 sec/per sec/in unit time	B1
7(b)(i)	(Part of wave where) pressure/density is higher OR molecules are closer together	B1
7(b)(ii)	At least 3 wavefronts shown as part semi-circles	B1
	Same separation between wavefronts drawn by candidate as for incident wavefronts	B1
7(b)(iii)	Less spreading out OR less diffraction	B1
7(c)(i)	$(\lambda =) v/f$ OR $340/6800$	C1
	0.050 m	A1
7(c)(ii)	In range 900 – 2000 m/s	B1
	Total:	8

Question	Answer	Marks
8(a)	Steel/aluminium/nickel/cobalt/alnico/neodymium/ferrite/alcomax	B1
8(b)(i)	Mention of <u>magnetic</u> field or <u>magnetic</u> flux OR field created by bar magnet	B1
	(Magnetic) field (lines) of magnet cut by coil OR (magnetic) field (lines) linked with/through/in the coil <u>changes</u> OR(magnetic) flux (through coil) <u>changes</u>	B1
	e.m.f. <u>induced</u>	B1
8(b)(ii)	Direction of movement of magnet through the coil OR which pole of magnet enters the coil	B1
	Direction of induced e.m.f. opposes change producing it OR (coil) end near magnet/left-hand end becomes a N-pole OR (coil) repels magnet (when moved in)	B1
8(c)	Hammer the magnet	M1
	repeatedly/until demagnetised/in E/W direction	A1
	OR Heat the magnet	(M1)
	high temperature/red hot/in E-W direction	(A1)
	OR Place magnet in coil carrying A.C.	(M1)
	Remove magnet from coil OR decrease the current (slowly) to zero	(A1)
	Total:	8

Question	Answer	Marks
9(a)(i)	LDR OR light-dependent resistor	B1
9(a)(ii)		B1
9(b)(i)	$I = V/R$	C1
	(total resistance =) $1.2 + 2.4$ OR 3.6 seen	C1
	$I = 6.0 / (1.2 + 2.4)$ OR 1.67 or 1.7 (mA)	C1
	$(V =) 4.0$ V	A1
	OR $(V_1) = [R_1 / (R_1 + R_2)] V$	(C1)
	(total resistance =) $1.2 + 2.4$ OR 3.6 seen	(C1)
	$(V_1) = (2.4 / 3.6) 6.0$	(C1)
	$= 4.0$ V	(A1)
9(b)(ii)	Replace the $1.2 \text{ k}\Omega$ resistor with one of higher value OR Increase the temperature (of the thermistor or the room)	B1
	Total:	7

Question	Answer	Marks
10(a)	Electrons/negative charges removed from/flow from/lost (from the object)	B1
10(b)(i)	At least 3 plus signs in top half of sphere	B1
	Same number of minus signs in bottom half of sphere	B1
	OR Excess of plus signs over minus signs in top half of sphere	(B1)
	Equal excess of minus signs over plus signs in bottom half of sphere	(B1)
10(b)(ii)	(with rod present) connect earth (to sphere) OR touch (sphere) with conductor/finger	M1
	Remove earth wire and then remove charged rod OR remove conductor/finger and then rod.	A1
		Total: 5

Question	Answer	Marks
11(a)	Background count rate stated as in range 17 – 21 counts/s	B1
	Background used on at least 2 of first 3 readings	C1
	Any halving of corrected or uncorrected reading	C1
	(half-life =) $\frac{1}{2}$ hour	A1
11(b)	${}^3_1 H$ on LHS of an equation	B1
	${}^0_{-1} \beta$ on RHS of equation	B1
	Equation all correct: ${}^3_1 H = {}^0_{-1} \beta + {}^3_2 X$	B1
11(c)	Top: any path to the left within 45° horizontal	B1
	Middle: path to the right and deflected down (ending in a straight line)	B1
	Bottom: path not deflected OR path to the right and deflected up <u>much</u> less than middle path	B1
	Total:	10

PHYSICS

0625/21

Paper 2 Multiple Choice

October/November 2016

MARK SCHEME

Maximum Mark: 40

Published

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	21

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	A	21	C
2	D	22	D
3	A	23	B
4	A	24	A
5	B	25	C
<hr/>			
6	B	26	D
7	A	27	D
8	C	28	A
9	A	29	B
10	C	30	A
<hr/>			
11	C	31	B
12	D	32	D
13	D	33	A
14	C	34	C
15	B	35	B
<hr/>			
16	A	36	C
17	C	37	D
18	B	38	C
19	B	39	D
20	D	40	C

PHYSICS

0625/41

Paper 4 Extended Theory

October/November 2016

MARK SCHEME

Maximum Mark: 80

Published

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Page 2	Mark Scheme Cambridge IGCSE – October/November 2016	Syllabus 0625	Paper 41
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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

M marks	are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.
B marks:	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answers.
A marks	In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it . For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored A C marks is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
brackets ()	around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
<u>underlining</u>	indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	indicates alternative answers, any one of which is satisfactory for scoring the marks.
e.e.o.o.	means "each error or omission".
o.w.t.t.e.	means "or words to that effect".
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction thermistor / transistor / transformer.
Not/NOT	Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.
Ignore	Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but only applies to marks annotated ecf.

Page 3	Mark Scheme Cambridge IGCSE – October/November 2016	Syllabus 0625	Paper 41
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Significant Figures	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question . No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.
Arithmetic errors	Deduct one mark if the only error in arriving at a final answer is clearly an arithmetic one.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly..
Fractions	(e.g. $\frac{1}{2}$) Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out and not replaced but can easily be read , should be marked as if it had not been crossed out.
Use of NR	(# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
1(a)(i)	Straight line from origin to (4.5 s, 7.2 m/s) Tolerance in plotting: $\frac{1}{2}$ a square	B2
1(a)(ii)	Use of area stated or implied by numbers used OR average speed \times time OR $s = (u+v)/t/2$ OR $vt/2$ OR $0.5 \times 4.5 \times 7.2$ $16(.2)$ m	C1 A1
1(b)	Rises from origin and curves with decreasing gradient Finishes horizontal	B1 B1
1(c)	Speed is scalar Velocity is vector Speed has magnitude/size/value (only) Velocity has magnitude/size/value and direction OR velocity has direction; speed does not	B1 B1
	Total:	8

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
2(a)(i)	(P =) hdg OR $15 \times 1000 \times 10$ 1.5×10^5 or 150 000 Pa or N/m ² or 150 kPa or kN/m ²	C1 A1
2(a)(ii)	(F =) PA OR $150\ 000 \times 6000$ 9.0×10^8 N / 9.0×10^5 kN	C1 A1
2(a)(iii)	Same value as (a)(ii) or 9.0×10^8 N	B1
2(b)	Weight of tanker has to be equal to upward force of water Depth (below surface) is / becomes less OR Tanker rises (Tanker rises) because pressure/force on bottom of tanker is greater OR because upthrust greater OR At same depth as in river, pressure/force on bottom of tanker is higher so tanker rises	B1 M1 A1
	Total:	8

Question	Answer	Marks
3(a)	(Molecules /they) collide with / hit walls of container OR rebound from walls of container Change of momentum OR Rate of change of momentum occurs OR $F = (mv - mu)/t$	B1 B1
3(b)(i)	($760 + 120 =$) 880 mmHg	B1
3(b)(ii)	Same value as (b)(i) or 880 mmHg	B1
3(b)(iii)	New pressure = ($760 + 240 =$) 1000 (mmHg) $PV = \text{constant}$ OR $P_1V_1 = P_2V_2$ OR $12 \times 880 = V \times 1000$ 11 cm^3	C1 C1 A1
	Total:	7

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
4(a)	Evaporation Molecules with higher/highest (kinetic) energy OR that gain enough energy escape (from the liquid surface) Molecules remaining in liquid have low/lower (kinetic) energy OR Energy for evaporation came from remaining liquid	B1 B1 B1 B1
4(b)	Greater decrease in temperature and/or volume than in (a). Fan removes vapour/blows vapour away/reduces humidity/reduces return of vapour to liquid, allowing more molecules to escape OR faster/more evaporation	B1 B1
4(c)	Metal is a <u>good</u> (thermal) conductor so passes heat <u>to</u> the liquid or <u>from</u> the surroundings (raising its temperature)	B1 B1
		Total: 8

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
5(a)	Molecular arrangement: Ice: in lattice/regular/arranged/orderly/fixed in place Water: random/irregular/not arranged/not orderly Molecular movement: Ice: vibrate Water: move (around) or slide over each other	B2
5(b)(i)	$d = m/V$ in any form OR ($m =$) Vd OR $1800 \times 0.025 \times 920$ = 41 000 kg	C1 A1
5(b)(ii)	($H =$) mL OR $41\,400 \times 3.3 \times 10^5$ $1.4 \times 10^{10} \text{ J}$ OR $1.4 \times 10^7 \text{ kJ}$ OR $1.4 \times 10^4 \text{ MJ}$	C1 A1
Total		6

Question	Answer	Mark
6(a)(i)	300 – 360 m/s	B1
6(a)(ii)	20 Hz – 20 kHz	B1
6(b)(i)	$v = f\lambda$ OR ($f =$) v/λ OR (a)(i)/0.022 Correct answer: e.g. 330 m/s gives 15 000 Hz	C1 A1
6(b)(ii)	Vertical dotted lines midway (by eye) between each pair of compressions OR to right or left of compressions shown with correct spacing (by eye)	B1
6(b)(iii)	(At rarefactions) molecules have above normal separation/far apart/spread out Pressure (of air) is below normal/low OR Molecules exert below normal/low pressure	B1 B1
	Total:	7

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
7(a)(i)	Ray continues through first face, without bending, to sloping face Ray reflected vertically down at sloping face	M1 A1
7(a)(ii)	Prism drawn with correct orientation in square Correct reflection to produce emergent ray	M1 A1
7(b)	Tick in box 2 Tick in box 6	B1 B1
		Total: 6

Question	Answer	Marks
8(a)	12 V	B1
8(b)	($I = V/R$) 12/8 OR 1.5 (A) ($W = IVt$) OR $1.5 \times 12 \times 40 (\times 60)$ OR ($W = I^2Rt$) OR $1.5^2 \times 8 \times 40 (\times 60)$ OR $W = V^2t/R$ OR $12^2 \times 40 (\times 60)/8$ 43 000 J	C1 C1 C1 A1
8(c)	Chemical (energy) to electrical (energy) (in battery) Electrical (energy) to thermal/heat (energy) (in resistor)	B1 B1
		Total: 7

Page 9	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
9	<p>Mention of overheating or fire seen anywhere Mention of electric shock or electrocution seen anywhere</p> <p>Any two of:</p> <p>Fire / overheating: if thin / extension cable carries too large a current OR because thin / extension cable has no fuse.</p> <p>Fire / overheating due to extension cable being coiled (so that escape of heat is prevented)</p> <p>Electric shock / electrocution (of gardener) if unsuitable socket lets in moisture / gets wet</p> <p>Electric shock / electrocution (of gardener) if tape repair lets in moisture / gets wet</p> <p>Electric shock / electrocution if cable is cut by mower and no circuit-breaker</p>	B1 B1 B2
		Total: 4

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
10(a)	(Wire) moves vertically or down (page) Moves up (page) OR Magnetic field is into the page OR (Fleming's) left hand-rule applies	C1 A1 B1
10(b)	Moves up and down (page)/ vibrates up and down (page) (Vertical) force on wire alternates OR due to interaction of field of magnet and alternating field (of current)	B1 B1
		Total: 5

Question	Answer	Marks
11(a)(i)	(Region) where a force acts on a charge	B1
11(a)(ii)	Direction of the force acting on a <u>positive</u> charge	B1
11(b)	At least 4 radial equally spaced straight lines drawn from surface of sphere Arrows on lines pointing away from sphere	B1 B1
11(c)(i)	Charges on sphere attract electrons (from earth) OR There is a p.d. between the sphere and earth	B1
11(c)(ii)	$I = Q/t$ in any form OR Q/t OR $20 \times 10^{-6} / (20 \times 60)$ $1.7 \times 10^{-8} \text{ A}$ OR $I = Q/t$ in any form OR Q/t OR $20 / (20 \times 60)$ $0.017 \mu\text{A}$	C1 A1 (C1) (A1)
		Total: 7

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0625	41

Question	Answer	Marks
12(a)(i)	Atomic number OR number of protons OR proton number	B1
12(a)(ii)	94	B1
12(b)	$\begin{array}{c} {}^{237}_{93}\text{Np} \\ \downarrow \\ {}^4_2\alpha \end{array}$	B1 B1
12(c)	(No of Am atoms remaining = $8 \times 10^{14} - 6 \times 10^{14} = 2 \times 10^{14}$) 4×10^{14} (Am atoms remain after) 470 yrs or 1 half-life $(2 \times 10^{14}$ Am atoms remain after) 940 yrs or 2 half-lives	C1 C1 A1
	Total:	7

PHYSICS

0625/21

Paper 2 Multiple Choice (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 40

Published

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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This document consists of **2** printed pages.

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<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	A	21	C
2	A	22	D
3	A	23	D
4	D	24	B
5	A	25	D
<hr/>			
6	C	26	B
7	B	27	D
8	C	28	A
9	B	29	B
10	C	30	A
<hr/>			
11	C	31	A
12	D	32	D
13	B	33	A
14	A	34	B
15	C	35	B
<hr/>			
16	C	36	C
17	D	37	B
18	A	38	D
19	B	39	D
20	A	40	B

PHYSICS

0625/41

Paper 4 Extended Theory

May/June 2016

MARK SCHEME

Maximum Mark: 80

Published

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Page 2	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0625	Paper 41
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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

M marks	are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.
B marks:	are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answers.
A marks	In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.
C marks	are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it . For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored A C marks is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
brackets ()	around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets. e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
<u>underlining</u>	indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	indicates alternative answers, any one of which is satisfactory for scoring the marks.
e.e.o.o.	means "each error or omission".
o.w.t.t.e.	means "or words to that effect".
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction / thermistor / transistor / transformer.
Not/NOT	Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.
Ignore	Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

Page 3	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0625	Paper 41
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ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but only applies to marks annotated ecf.
Significant Figures	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question . No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.
Arithmetic errors	Deduct one mark if the only error in arriving at a final answer is clearly an arithmetic one.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly..
Fractions	(e.g. $\frac{1}{2}$) Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out and not replaced but can easily be read , should be marked as if it had not been crossed out.
Use of NR	(# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Page 4	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0625	Paper 41
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Question	Answer	Mark
1(a)	From time zero, line of constant positive gradient, not necessarily from origin Horizontal line from end of sloping line Line of steeper positive gradient from end of horizontal line	B1 B1 B1
1(b)	(distance =) area under graph stated $0.5 \times 7.5 \times 3.3 (= 12.375)$ $+ 12.5 \times 3.3 (= 41.25)$ $+ 0.5 \times 5 \times 3.3 (= 8.25)$ OR $\frac{1}{2} (a + b)h$ $= 0.5 \times (25 + 12.5) \times 3.3$ OR $(25 \times 3.3) - (0.5 \times 12.5 \times 3.3)$ 62 m	C1 C2 (C1) (C1) (C2) A1
		Total: 7

Question	Answer	Mark
2(a)(i)	(momentum =) mv OR 70×20 $= 1400 \text{ kg m/s}$ OR Ns	C1 A1
2(a)(ii)	same numerical answer as (a)(i) with either unit OR 1400 kg m/s	B1
2(b)	($a =$) change of velocity/time OR $(v - u)/t$ OR $20/0.2$ 100 m/s^2	C1 A1
2(c)	($F =$) ma OR 70×80 5600 N	C1 A1
2(d)	Force/impact on passenger or dummy less (than without seat belt/airbag) Passenger less likely to be injured/hurt/damaged	M1 A1

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0625	41

Question	Answer	Mark
		Total: 9

Question	Answer	Mark
3(a)(i)	(P =) hdg OR $1.5 \times 850 \times 10$ OR mg / area of base OR $850 \times 2.4 \times 1.5 \times 1.5 \times 10 / (2.4 \times 1.5)$ $13\ 000 \text{ Pa or N/m}^2$	C1 (C1) A1
3(a)(ii)	$P = F/A$ OR (F =) PA OR $12\ 750 \times 1.5 \times 2.4$ OR $12\ 750 \times 3.6$ 46 000 N OR (Force =) weight of oil = mg = $2.4 \times 1.5 \times 1.5 \times 850 \times 10$ 46 000 N	C1 A1 (C1) (A1)
3(b)	$(46000 / 10 =) 4600 \text{ kg}$ OR $m = Vd = (2.4 \times 1.5 \times 1.5) \times 850 = 4600 \text{ kg}$	B1
3(c)(i)	(density of brass) greater than that of oil / 850 kg/m^3 OR brass denser <u>than oil</u>	B1
3(c)(ii)	(It won't sink as average) density of wood + key less than density of oil	B1
		Total: 7

Page 6	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0625	Paper 41
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Question	Answer	Mark
4(a)	Gas molecules (very) far apart OR empty space between gas molecules Molecules of liquid (very) <u>close together</u> /compact OR are touching (each other)	B1 B1
4(b)(i)	Faster/more energetic water molecules evaporate/escape/leave Slower/less energetic molecules remain (so temperature is lower)	B1 B1
4(b)(ii)	Water in wide container AND has water with larger surface (area) Rate of evaporation higher/faster/quicker OR higher chance of evaporation	B1 B1
		Total: 6

Question	Answer	Mark
5(a)	One of 1, 2 or 3: 1 Molecules move faster OR have more k.e./momentum 2 Molecules <u>hit walls</u> more often/more frequently 3 Molecules <u>hit walls</u> with greater force/impulse/harder	B1
5(b)	1 mark for each of 1, 2 and 3 in (a) not given as answer to (a)	B2
5(c)(i)	$PV = \text{constant}$ OR $P_1V_1 = P_2V_2$ OR $98 \times 4800 = P \times 7200$ 65 kPa	C1 A1
5(c)(ii)	To prevent the balloon bursting (as its volume increases) OR to reduce the pressure inside the balloon OR pressure difference between inside and outside balloon rises	B1
		Total: 6

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0625	41

Question	Answer	Mark
6(a)	<p><u>Method 1:</u> Long distance/distance in field measured <u>with the tape</u> One student fires pistol at one end (of this distance) Student at other end starts stop-watch on seeing smoke/light from pistol and stops stop-watch on hearing sound of pistol $\text{speed} = (\text{measured distance}) / (\text{measured time})$</p> <p><u>Method 2:</u> Distance of 50 m or more from a vertical wall measured <u>with the tape</u> Student 1 fires pistol at this distance from the wall Student 2 <u>standing next to student 1</u> starts stop-watch on hearing pistol and stops stop-watch on hearing echo $\text{speed} = 2 \times (\text{measured distance}) / (\text{measured time})$</p>	B1 B1 B1 B1 (B1) (B1) (B1) (B1)
6(b)(i)	$v = f\lambda$ OR ($\lambda = v/f$) OR $1500/200$ 7.5 m	C1 A1
6(b)(ii)	1 (frequency) does not change 2 (speed) decreases	B1 B1
		Total: 8

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0625	41

Question	Answer	Mark
7(a)(i)	Sketch of <u>curved</u> optic fibre with light ray undergoing at least one total internal reflection	B1
7(a)(ii)	<p>Light travels down (optic) fibres into or out of body</p> <p>To examine internal organ/part Light travels both ways into and out of body OR To destroy (cancerous) cells by heating OR Endoscope/fibre bundle inserted into body To view internal organ body part OR for keyhole surgery</p>	B1 B1 B1 (B1) (B1) (B1) (B1)
7(b)	<p>Light in air: 3×10^8 m/s</p> <p>Microwaves in vacuum: 3×10^8 m/s</p> <p>Sound in steel: 6000 m/s</p>	B1 B1 B1
7(c)	<p>$n = \text{speed in air} / \text{speed in glass}$ (or rearranged) OR $1.5 = 3 \times 10^8 / \text{speed in glass}$ (or rearranged) 2.0×10^8 m/s</p>	C1 A1
		Total: 9

Page 9	Mark Scheme Cambridge IGCSE – May/June 2016	Syllabus 0625	Paper 41
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Question	Answer	Mark
8(a)(i)	Magnetic field at Y: 'towards the bottom of the page' ticked Force at Y: 'to the left' ticked	B1 B1
8(a)(ii)	There is a force on X because of the (magnetic) field caused by Y OR due to the (magnetic) field around / of Y OR the (magnetic) fields due to X and Y interacting	B1
8(b)	Change in current/field is brief/for short time/occurs as switch closes Changing magnetic field/flux links with secondary coil/other coil/core OR field/flux lines cut coil Causes induced voltage/current	B1 B1 B1
		Total: 6

Question	Answer	Mark
9(a)(i)	12Ω	B1
9(a)(ii)	$1/R = 1/R_1 + 1/R_2$ OR $1/R = 1/12 + 1/6$ OR ($R = R_1R_2/(R_1 + R_2)$) OR $(12 \times 6)/(12 + 6)$ 4Ω	C1 A1
9(a)(iii)	$4 + 6 = 10\Omega$	B1
9(b)(i)	$(I = 12/10 =) 1.2A$	B1
9(b)(ii)	$(E =) IVt$ OR $1.2 \times 12 \times 50$ OR I^2Rt OR $1.2^2 \times 10 \times 50$ OR V^2t/R OR $12^2 \times 50/10$ $720J$	C1 A1
		Total: 7

Page 10	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0625	41

Question	Answer		Mark
10(a)(i)	Light emitting diode OR LED		B1
10(a)(ii)			B1
10(b)	column C 0 0 0 0 0 0 1 1	column E 0 1 0 1 0 1 1 1	
			B3
10(c)	Replace the OR gate with an AND gate		B1
			Total: 6

Question	Answer	Mark
11(a)	83 protons 131 neutrons	B2
11(b)	${}^0_{-1}\beta$ Superscript 0 Subscript -1 ${}^{214}_{84}\text{Po}$	B1 B1 B1
11(c)	(After 20 min count rate is) $360/2$ or 180 (count/s) (After 40 min count rate is) $180/2$ or 90 (counts/s) (After 60 min count rate is) $90/2$ OR new count-rate = $360/(2 \times 2 \times 2)$ or $360/8$ or 3 half-lives 45 (counts/s)	C1 A1

Page 11	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0625	41

Question	Answer	Mark
11(d)	<p>Any two points chosen from the lists below:</p> <p>(economic): high cost of storage / shielding / guarding / need to store for a long time OR reduction in tourism OR loss of farming produce / land OR reduction of land / property values</p> <p>(social): fear of cancer / causes cancer / genetic mutations / radiation sickness in people / animals OR local objections OR cause people to move away</p> <p>(environmental): crop mutations OR leakage into water supplies OR pollution <u>of atmosphere</u> / water supply</p>	B2
		Total: 9

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0625	21

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

- B marks are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen in the candidate's answer.
- M marks are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
- C marks are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows he or she knew the equation, then the C mark is scored.
- A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored.
- Brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
- c.a.o. means "correct answer only".
- e.c.f. means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he or she may be given marks indicated by e.c.f. provided his or her subsequent working is correct, bearing in mind his or her earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated "e.c.f."
- e.e.o.o. means "each error or omission".
- owtte means "or words to that effect"
- Underlining indicates that this must be seen in the answer offered, or something very similar.
- OR indicates alternative answers, any one of which is satisfactory for scoring the mark.
- AND indicates that both answers are required to score the mark.
- Spelling Be generous about spelling and use of English. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction or thermistor/transistor/transformer.
- Significant figures Answers are generally acceptable to any number of significant figures ≥ 2 , except where the mark scheme specifies otherwise.
- Units On this paper, incorrect units are not penalised, except where specified. More commonly, marks are allocated for specific units.

Page 3	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0625	Paper 21
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Fractions These are only acceptable where specified.

NOT indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate. i.e. right plus wrong penalty applies.

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0625	21

- 1 (a) (i) measuring OR graduated cylinder B1
 (ii) balance B1

(b) Honey has a larger density than water. B1
 Kerosene has a smaller density than water. B1

(c) density = mass/volume in any form: words, symbols, numbers C1
 10.5/13 C1
 0.81 A1
 g/cm³ B1

[Total: 8]

- 2 (a) (i) calculation seen using times from cameras A and B C1
160 (s) A1

(ii) speed = distance/time in any form: words, symbols, numbers C1
 5000/160 C1
 31.3 (m/s) A1

(iii) much slower than between A and B B1

(b) less/lower than suggested speed limit B1
 either reference to just over limit between cameras A and B B1
 then much slower speed, so average below limit B1
 OR average speed over 10 000 m is about 15 m/s (for B2)

[Total: 9]

- 3 (a) three lines required: B1
 • line from solid to bottom pattern
 • line from liquid to middle pattern
 • line from gas to top pattern

(b) (i) any two from: B2
 • energy needed to turn liquid into a gas
 • remaining perfume/liquid/particles have lower energy
 • energy transfers from arm to perfume (cooling arm)

(ii) particles move/evaporate faster (when hotter) B1
 collisions (with stopper) harder/more often B1
 pressure greater (inside than outside) OR
 force on stopper (from perfume) greater than friction + stopper weight B1

[Total: 6]

Page 5	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0625	Paper 21
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- 4 (a)** any two from: B2
- microwave not heard/sound is heard
 - sound is slower/longitudinal wave or signal is transverse
 - sound needs medium/cannot travel through a vacuum
 - signal is electromagnetic wave owtte
 - sound has longer wavelength/lower frequency

- (b) (i)** reflected B1
- (ii)** diffracted B1

[Total: 4]

- 5 (a)** 100 ($^{\circ}\text{C}$) B1
- 0 ($^{\circ}\text{C}$) B1

- (b)** thermometer (bulb) placed in ice
melting ice OR ice and water mixture C1
A1

- (c)** expansion B1

[Total: 5]

- 6 (a)** wind B1

- (b)** electrical
light B1
B1

- (c) (i)** dark
no wind/calm B1
B1

- (ii)** (back-up/rechargeable) battery B1

- (d)** gravitational potential (energy) B1

[Total: 7]

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0625	21

- 7 (a) A: arrow pointing left/away from N
 C: arrow pointing left/same as A
 B and D: arrow pointing right

B1
 B1
 B1

- (b) correct field lines carefully drawn through B and D

B1

- (c) steel

B1

[Total: 5]

- 8 (a) (i) any two from:
 • (small current in) relay coil produces magnetic field
 • relay coil attracts armature
 • starter motor connected across battery p.d.

B2

- (ii) lower (electrical) resistance
 less heating (in cable)

B1
 B1

- (b) (i) 1.2 (A)

B1

- (ii) if a lamp fails other will work OR
 each lamp can be controlled by a switch

B1

[Total: 6]

- 9 (a) (i) thermistor correctly labelled
 (ii) correct symbol for voltmeter
 voltmeter in parallel with thermistor OR e.c.f. (a)(i)

B1
 B1
 B1

- (b) (i) $R = V/I$ in any form: words, symbols, numbers
 6.0/0.004 OR 6.0/4.0
 1500
 Ω OR ohm(s)

C1
 C1
 A1
 B1

- (ii) not a straight line/constant gradient OR not through origin

B1

[Total: 8]

Page 7	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0625	Paper 21
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10 (a) resistance of LDR decreases
current increases M1
A1

(b) (i) ray from object parallel to axis
ray continued correctly through F M1
A1

(ii) second ray correctly drawn through centre of lens OR through F
intersection of two or more rays B1
B1

(iii) image at intersection drawn and labelled correctly A1

[Total: 7]

11 (a) Gamma/ γ B1

(b) (i) nucleon (accept mass)
proton (accept atomic) B1
B1

(ii) $A = 4$
 $Z = 2$ B1
B1

(iii) alpha/ α (particle) B1

[Total: 6]

12 (a) (i) turbine B1

(ii) any two from:

- produces sulfur oxides/nitrous oxides
- produces carbon dioxide
- (fossil fuels/they) are non-renewable/not sustainable (resources)

B2

(b) $V_1/V_2 = N_1/N_2$ C1
 $115/25 \times 500$ C1
2300 A1

(c) smaller current (in transmission cables)
smaller heating effect (in transmission cables)
less energy wasted (in)/more efficient (transmission) B1
B1
B1

[Total: 9]

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0625	31

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

- M marks are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.
- B marks are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
- A marks A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. An A mark following an M mark is a dependent mark.
- C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
- brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
- underlining indicates that this must be seen in the answer offered, or something very similar.
- OR/or indicates alternative answers, any one of which is satisfactory for scoring the mark.
- e.e.o.o. means "each error or omission".
- o.w.t.t.e. means "or words to that effect".
- Ignore indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction or thermistor/transistor/transformer.
- Not/NOT indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.
- cao correct answer only.
- AND indicates that both answers are required to score the mark.

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ecf	meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but only applies to marks annotated ecf.
Significant Figures	Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Condone wrong use of upper and lower case symbols, e.g. pA for Pa.
Fractions	Only accept these where specified in the mark scheme.

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1 (a) point marked P (on line or time axis) at $t \geq 2.0$ s B1

(b) (i) attempt at gradient OR ($a =$) $\Delta v/t$ OR $(v - u)/t$ OR $240 (-0)/2.0$
OR division of correct points on graph
 120 m/s^2 C1
A1

(ii) suggestion of area (under graph) in words or formula or numbers
OR $0.5 (120 + 240) \times 1.0$ OR $[(120 \times 1.0) + (0.5 \times 120 \times 1.0)]$ C1
 180 m A1

(c) mass of sled changes/decreases OR fuel used up B1

[Total: 6]

2 (a) (i) any scalar quantity other than mass B1

(ii) any vector quantity other than force B1

(b) $F = ma$ in any form OR ($a =$) F/m
 $50\ 000/290\ 000$ OR $50/290$
 $a = 0.17 \text{ m/s}^2$ C1
C1
A1

(c) (i) 1 cm: $20\ 000 \text{ N}/20 \text{ kN}$ B1

(ii) triangle completed
230 000 N OR 230 kN in range 220 000 N – 240 000 N/220 kN – 240 kN B1
B1

by calculation: 110°
OR by measurement: 108° – 112° B1

[Total: 9]

3 (a) (g.p.e.=) mgh OR $75 \times 10 \times 880$
 $= 6.6 \times 10^5 \text{ J/Nm}$ OR 660 kJ/kNm C1
A1

(b) (i) (work =) Fs/Fd OR 220×2800
 $= 6.2 \times 10^5 \text{ J/Nm}$ OR 620 kJ/kNm C1
A1

(ii) answer to (a) – answer to (b)(i)
e.g. (k.e.=) $6.6 \times 10^5 - 6.2 \times 10^5 = 4.0 \times 10^4 \text{ J}$ OR 44 kJ
 $OR 6.6 \times 10^5 - 6.16 \times 10^5 = 4.0 \times 10^4 \text{ J}$ OR 44 kJ C1
A1

(c) (to go faster by) reduced air resistance/drag/resistive force
OR to lower centre of mass OR increase stability/balance B1

[Total: 7]

Page 5	Mark Scheme Cambridge IGCSE – October/November 2015	Syllabus 0625	Paper 31
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4 (a) $c = Q / (m\Delta\theta)$ B1

(b) (i) $d = m/V$ in any form OR ($m =$) Vd OR 0.0036×1000
3.6 kg C1
A1

(ii) ($E =$) Pt OR 8500×60 OR $510\,000$ J OR 5.1×10^5 J C1
 $\Delta\theta = Q/mc$ OR $\Delta\theta = Pt/mc$ in any form OR $5.1 \times 10^5 / (3.6 \times 4200)$ C1
 $= 34 (\text{ }^\circ\text{C})$ A1

OR $\Delta\theta = P / (\text{mass per second} \times c)$ (C1)
 $= 8500 / [(0.0036/60) \times 4200]$ (C1)
 $= 34 (\text{ }^\circ\text{C})$ (A1)

outflow temp = $15 + 33.73 = 49 \text{ }^\circ\text{C}$ B1

[Total: 7]

5 (a) any **two** of motion of smoke particles:
 random/haphazard/unpredictable movement;
 sudden changes of direction/zig-zag motion;
 appear/disappear from view OR go out of/come into focus; B2

any **two** of conclusions about air molecules:
 collide with smoke particles OR smoke particles collide with/moved by air molecules;
 air molecules fast(er);
 air molecules small(er)/light(er);
 move randomly; B2

(b) (i) 1 (the piston) moves to the right/out(wards) / is pushed away B1
 2 (the pressure of the gas) remains constant B1

(ii) (pressure of the gas) increases B1
 more frequent collisions (of gas molecules) with piston/walls/container
 OR (gas molecules) collide with piston/walls/container with great(er) force B1

[Total: 8]

Page 6	Mark Scheme	Syllabus	Paper
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6 (a) (in compressions) pressure higher OR molecules/atoms/particles close(r) together/ (more) tightly packed B1

(b) (i) $v = f\lambda$ in any form OR ($\lambda =$) v/f OR $340/850$
 $= 0.40 \text{ m}$ C1
A1

(ii) distance (of compression A from barrier) $= 2.5 \times 0.40$ OR 1.0 m C1
time (to reach barrier) $= 1/340 = 2.9 \times 10^{-3} \text{ s}$ OR 2.9 ms A1

OR $T (= 1/f) = 1/850$ OR $0.4/340$ OR 1.2×10^{-3} (C1)
(moves 2.5 wavelengths:) time $= 2.5/850 = 2.9 \times 10^{-3} \text{ s}$ OR 2.9 ms (A1)

(c) two circular arcs centred on mid-point of gap in barrier by eye
along centre line, arcs separated by the same distance as adjacent compressions approaching barrier B1
B1

(d) (speed in water) greater OR numerical value greater than 340 m/s B1

[Total: 8]

7 (a) (i) boxes ticked:
enlarged
upright
virtual B3

(ii) E marked anywhere to right of lens B1

(iii) magnifying glass(es) or lens/eyepiece of telescope/microscope/binoculars B1

(b) object in correct position and correct size and F in correct position from label or
correct ray intersection with axis B1
two correct rays M1
image between 28 mm and 38 mm from lens and labelled as word or letter A1

[Total: 8]

8 (a) (Q =) It OR $4.1 \times 10^{-5} \times 1.6 \times 10^7$
 $= 660 \text{ C}$ C1
A1

(b) (R =) V/I OR $1.3/4.1 \times 10^{-5}$
 $= 32000 \Omega$ OR $32 \text{ k}\Omega$ C1
A1

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- (c) 1st method: $(P =) IV$ OR $4.1 \times 10^{-5} \times 1.3$
 OR 2nd method: $(P =) I^2R$ OR $(4.1 \times 10^{-5})^2 \times 32000$
 OR 3rd method: $(P =) V^2/R$ OR $1.3^2/32000$
 OR 4th method: $(P =) QV/t$ OR $660 \times 1.3 / 1.6 \times 10^7$

C1

- 1st and 3rd methods: $5.3 \times 10^{-5} \text{ W} / 0.000053 \text{ W}$
 2nd and 4th methods: $5.4 \times 10^{-5} \text{ W} / 0.000054 \text{ W}$

A1

[Total: 6]

- 9 (a)** (step-down) transformer B1

- (b)** (alternating current causes) magnetic field in core/iron
 magnetic field changes/alters
 field cuts/links with secondary coil OR secondary coil cuts field
 e.m.f. / voltage **induced** (and current flows in lamp)
 OR **induced** current (in lamp)

B1

B1

B1

B1

- (c) (i)** $V_1/V_2 = N_1/N_2$ in any form OR $(N_1 =) N_2 \times V_1/V_2$ OR $450 \times 240/12$
 $= 9000$

C1

A1

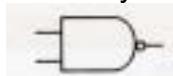
- (ii)** tick 4th box B1

[Total: 8]

- 10 (a) (i)** OR (gate) B1

- (ii)** 1 input and 1 output labelled with words B1

- (iii)** correct symbol



B1

- (b) (i)** needle not deflected B1

- (ii)** needle not deflected B1

- (iii)** needle deflected either way B1

[Total: 6]

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11 (a) different number of neutrons (in the nucleus) OR different neutron number B1

(b) (i) 1 letter Q at nucleon number = 208 B1
proton number = 81 B1

2 letter R at nucleon number = 212 B1
proton number = 84 B1

(ii) evidence of dividing original number by 2 C1
75 (counts)/min OR 1.25 (counts)/s OR 4500 (counts)/hr A1

[Total: 7]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

B marks	are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen in the candidate's answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers must be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
C marks	are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows he knew the equation, then the C mark is scored.
A marks	are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored.
Brackets ()	around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
c.a.o.	means "correct answer only".
e.c.f.	means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he may be given marks indicated by e.c.f. provided his subsequent working is correct, bearing in mind his earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but only applies to marks annotated "e.c.f."
e.e.o.o.	means "each error or omission".
<u>Underlining</u>	indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	indicates alternative answers, any one of which is satisfactory for scoring the mark.
AND	indicates that both answers are required to score the mark.
Spelling	Be generous with spelling and use of English. However, do not allow ambiguities e.g. spelling which suggests confusion between reflection/refraction/diffraction or thermistor/transistor/transformer.
Sig. figs.	On this paper, answers are generally acceptable to any number of significant figures ≥ 2 , except where the mark scheme specifies otherwise or gives an answer to only 1 significant figure.
Units	On this paper, incorrect units are not penalised, except where specified. More commonly, marks are awarded for specific units.
Fractions	Fractions are only acceptable where specified.

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Extras	If a candidate gives more answers than required, irrelevant extras are ignored; for extras which contradict an otherwise correct response, or are forbidden by the mark scheme, use right plus wrong = 0.
Ignore	indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.
NOT	indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.

Page 4	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0625	Paper 21
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- 1 (a) any two from: B2
- gap between ruler and stack
 - eye not perpendicular/ level with top of stack
 - zero error of ruler

(b) $7.7 \div 20$ C1
0.385(cm) OR 0.39(cm) A1

(c) 0.012(kg) c.a.o. B1

[Total: 5]

- 2 (a) 40(km) B1

(b) speed = distance ÷ time in any form C1
 $0.5 \div 0.04$ C1
12.5 m/s A1

(c) (i) distance travelled = area under slope OR $0.5 \times 15 \times 6$ C1
45(m) A1

(ii) (straight) line from 15 m/s to 0 in 2.0 seconds A1

[Total: 7]

- 3 (a) (i) any answer in range 40 to 100 kg OR equivalent in g B1

(ii) mass of chair is the same on the moon B1

(b) (i) pressure greater in Fig. 3.2 OR reverse argument B1
force/weight is the same B1
smaller (contact/surface) area B1

(ii) vertical line through centre of mass drawn or explained B1
centre of mass outside base area of chair/beyond back leg of chair B1

[Total: 7]

- 4 chemical B1
kinetic B1
thermal B1
sound B1

[Total: 4]

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- 5 (a) (i) C in box B1
 (ii) A AND C in any order B1

- (b) any 5 points in any order from: B5
- starting pistol fired
 - stopwatch started on seeing smoke/signal
 - stopwatch stopped on hearing bang
 - time taken (between flash and bang) calculated/recoded
 - distance measured OR at least 100m apart, IGNORE distances less than 100m
 - speed = distance ÷ time

[Total: 7]

- 6 (a) (i) 380 (mm) AND 220 (mm) B1
 (ii) 380–220 OR 160 OR ecf from (a)(i) C1
 760 + 160 OR ecf from (a)(i) ECF C1
 920 (mmHg) OR ecf from (a)(i) A1

- (b) (i) decreases B1
 (ii) molecules slow down OR (average) speed/movement decreases
 OR molecules have less (average kinetic) energy B1
 molecules closer B1

[Total: 7]

- 7 (a) (i) conduction B1
 (ii) 1. water expands when heated B1
density (of warm water) decreases OR reverse argument B1
 warm water rises B1
 2. convection B1

- (b) (i) reduce heat losses OR to act as insulation B1
 (ii) any two from: B2
 - economic reason: lower costs OR cheaper OR more efficient
 - environmental reason: less greenhouse gases OR maintain fuel reserves
 - reason to do with system: maintain temperature of water OR less energy needed to keep water hot OR water stays hotter for longer

[Total: 8]

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- 8 (a) (i) angle of refraction correctly labelled B1
(ii) normal B1

(b) (i) light ray shown undergoing TIR/turns through 90° B1
(ii) total internal (reflection) B1
(iii) angle of incidence = angle of reflection OR angle of incidence greater than critical angle B1

[Total: 5]

- 9 (a) alternating voltage **OR** a.c. (supply) B1

(b) motor (accept fan) **AND** lamp B1

(c) line 1 tick and then tick
line 2 cross/nothing and then tick
line 3 tick and then cross/nothing B3

(d) $V=IR$ in any form B1

(e) 50×5
250 A1 C1 A1

(f) any two from:
• current too large
• fuse wire melts/"blows"
• breaks circuit
• prevents overheating/fires/damage to other components B2

[Total: 10]

- 10 (a) iron clearly indicated
steel clearly indicated B1
B1

(b) test to see if there is repulsion/attraction
clear indication that repulsion identifies the magnets C1
A1

(c) steel B1

Page 7	Mark Scheme Cambridge IGCSE – May/June 2015	Syllabus 0625	Paper 21
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(d) (i) iron filings **OR** (plotting) compass B1

(ii) at least two complete concentric circles around wire B1

[Total: 7]

11 (a) transverse waves **OR** travel at same (high) speed **OR** travel across a vacuum B1

(b) infra-red next to visible
microwaves next to radio waves B1
B1

(c) gamma rays B1

(d) (i) medical imaging **OR** security scanning (at airports etc.) **OR** dentistry
OR finding defects in welding B1

(ii) use of shielding **OR** monitor exposure B1

[Total: 6]

12 (a) 3 plots all correct
good best-fit single line curve B1
B1

(b) point at 40 days indicated C1

775 ± 75 A1

(c) initial count rate halved **OR** pair of count rates indicating halving
at least one corresponding time from graph
20 days \pm 2 days C1
C1
A1

[Total: 7]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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- owtte means "or words to that effect".
- Underlining indicates that this must be seen in the answer offered, or something very similar.
- OR/or indicates alternative answers, any one of which is satisfactory for scoring the mark.
- AND indicates that both answers are required to score the mark.
- Spelling Be generous with spelling and use of English. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction or thermistor/transistor/transformer.
- Sig. figs. On this paper, answers are generally acceptable to any number of significant figures ≥ 2 , except where the mark scheme specifies otherwise or gives an answer to only 1 significant figure.
- Units Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: **maximum 1 per question**.
- Fractions Fractions are only acceptable where specified.

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- Extras** If a candidate gives more answers than required, irrelevant extras are ignored; for extras which contradict an otherwise correct response, or are forbidden by the mark scheme, use right plus wrong = 0.
- Ignore** indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.
- NOT** indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

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- 1 (a) (i) acceleration OR increasing speed C1
 constant acceleration OR constant rate of increase in speed A1
 (ii) decreasing acceleration OR decreasing rate of increase in speed NOT deceleration B1
- (b) mention of air resistance AND weight (of object) / force due to gravity B1
 acceleration at start (of fall) is acceleration of gravity / 10 m/s^2 / a maximum / g OR acceleration decreases (as it falls) B1
 air resistance increases as speed increases/as it accelerates B1
 acceleration zero/terminal velocity/constant speed/maximum speed when air resistance = weight B1

[Total: 7]

- 2 (a) (i) $(P =) F \div A$ OR $3.5 \times 10^4 \div 0.25$ C1
 $= 1.4 \times 10^5 \text{ Pa}$ ecf (i) A1
 (ii) $(1.4 \times 10^5 - 1.0 \times 10^5 =) 4(.0) \times 10^4 \text{ Pa}$ ecf (ii) B1
 (iii) $P = h \rho g$ in any form OR $(h =) P \div \rho g$ OR $4.0 \times 10^4 \div (1020 \times 10)$ C1
 $= 3.9 \text{ m}$ OR 4 m A1
- (b) any 2 from:
 • weight of block
 • upward force of water (on block) / upthrust (of water on block)
 • weight of cable max. B2
- (c) (tension force) becomes smaller or zero B1

[Total: 8]

- 3 (a) $W = mg$ in any form OR $(m =) W \div g$ OR $80000 \div 10$ C1
 8000 kg A1
- (b) $\rho = m \div V$ in any form OR $(V =) m \div \rho$ OR $8000 \div 1000$ C1
 $= 8.0 \text{ m}^3$ ecf (a) A1
- (c) mgh OR weight $\times h$ OR $8000 \times 10 \times 4$ C1
 $= 320000 \text{ J}$ OR 320 kJ ecf (a) A1

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(d) (efficiency =) output (energy) ÷ input (energy) ($\times 100$)

OR $96 \div 320 (\times 100)$

C1

= 0.30 OR 30% ecf (c)

A1

[Total: 8]

4 (a) (i) any 2 from:

max. B2

- liquid molecules not in fixed positions / can move about / move past each other OR solid molecules have a fixed position
- liquid molecules have random arrangement OR solid molecules arranged regularly / in patterns / layers / lattice
- liquid molecules are (slightly) further apart (than solid molecules) OR reverse argument

(ii) energy / work / thermal energy / (latent) heat required

AND

to break bonds (between molecules) / to overcome attractive forces (between the molecules) / to increase the potential energy of the molecules

B1

(b) (i) $E = ml$ in any form OR ml OR $1.65 \times 330\,000$

C1

= 540 000 J OR 544 500 J

A1

(ii) chemical (energy in body) converted to thermal / internal (energy)

B1

[Total: 6]

5 (a) energy/heat required to increase temperature

B1

- of 1 kg / 1 g / unit mass (of the substance)
- by 1°C / 1 K / unit temperature

B1

(b) $E = mc\Delta\theta$ in any form OR ($c =$) $E \div m\Delta\theta$

C1

$E = Pt$ in any form OR $420 \times 95 (= 39\,900)$

C1

$\Delta\theta = [40.5 - 19.5]$ OR 21

C1

($c = 39\,900 \div 42 = 950 \text{ J/(kg }^\circ\text{C)}$)

A1

(c) any two separate points from:

max. B2

- lagging / insulation (around block) OR insulate (the block)

- raise temperature of block by a smaller amount OR heat for a shorter time OR use lower power heater for same time OR higher power for same temperature rise / shorter time

- polish the surface of the block OR wrap the block in shiny material OR paint (shiny) white

- reduce initial temperature of block (to below room temperature) OR raise temperature of room

- reduce draughts

[Total: 8]

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6 (a) (i) any value between 6 and 7 mm seen C1

$26 \pm 2 \text{ mm}$ OR $2.6 \pm 0.2 \text{ cm}$ A1

(ii) $v = f\lambda$ in any form OR $(f =) v \div \lambda$ OR $0.39 \div 0.026$
 $= 15 \text{ Hz}$ ecf (i) C1
A1

(b) at least 4 wavefronts showing refraction in correct direction B1
7 parallel wavefront lines continuous with those in fast region B1

(c) unchanged / nothing B1

[Total: 7]

7 (a) (i) all three of: max. B2

- virtual,
 - upright / erect / same way up,
 - magnified / large(r) (than object)
- award 1 mark for one or two correct description(s) which are not contradicted

(ii) RS B1

(iii) eye placed to right of lens B1

(b) any two correct rays from: max. B2

- ray parallel to axis refracted through F
- ray passing through centre of lens undeflected
- ray through added focus to left of lens refracted parallel to axis

image from intersection of rays clearly shown as inverted B1

3 correct rays drawn on Fig. 7.2, from tip of O to intersection of other two rays and refracted correctly at lens

note: the third ray does not have to be one of those listed above

B1

[Total: 8]

8 (a) (i) (magnetic) field (lines) of magnet cut by turns / coil / wire
OR (magnetic) field linked with coil changes B1

(ii) 1 (needle of meter) deflects to the left (and returns to zero) B1

2 (needle of meter) deflects to right and left (alternately)
OR to and fro B1

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(b) (i) $N_p/N_s = V_p/V_s$ in any form OR $(N_s =) N_p V_s / V_p$ OR $8000 \times 6/240$
 OR $(V_p/V_s =) 40$
 $(N_s =) 200$ C1
 A1

(ii) 1 $(P = IV = 0.050 \times 240 =) 12W$ B1

2 0.9×12 OR 10.8 OR $I_s V_s = 0.9 I_p V_p$ OR $I_s = 0.9 I_p V_p / V_s$
 OR $0.9 \times 0.05 \times 240/6$
 $(I_s =) 1.8A$ ecf 1. C1
 A1

[Total: 8]

9 (a) (i) $1/R = 1/R_1 + 1/R_2$ OR $R = R_1 R_2 / (R_1 + R_2)$ OR with numbers
 $(R =) 500\Omega$ C1
 A1

(ii) $I = (12 \div 1000) = 0.012A$ ecf (i) B1

(iii) $(V =) IR$ OR 0.012×500 OR $12 \times 500 \div 1000$
 $= 6.0V$ ecf (i)(ii) C1
 A1

(b) (more current in circuit so) current (in 500Ω resistor) increases B1

resistance of parallel combination decreases
 OR total resistance (of circuit) decreases B1

[Total: 7]

10 (a) (i) at least three horizontal, parallel lines evenly spaced (ignore edge effects) B1
 arrows pointing left to right B1

(b) right hand half of ball has more + signs than – signs
 AND left hand half of ball has more – signs than + signs M1

equal numbers of + and – signs A1

(c) $Q = It$ in any form OR $(I =) Q \div t$ OR $2.8 \times 10^{-8} \div 0.05$
 $5.6 \times 10^{-7} A$ OR C/s C1
 A1

[Total: 6]

11 (a) electromagnetic (waves / radiation / rays / spectrum)
 OR (high energy) photons B1

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(b) α and β deflected in opposite directions B1

any 1 from: B1

- β deflected more (than α)
- deflections perpendicular to field direction and to paths of particle
- paths (of particles) are curves / circular / arcs

(c) curved path B1

(deflected/attracted) towards positively charged plate B1
OR in opposite direction to field

(d) (i) α -particle OR helium nucleus OR 2 protons + 2 neutrons B1

(ii) $A = 210$ $Z = 84$ B1

[Total: 7]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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.

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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

- B marks** B marks are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
- M marks** M marks are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
- C marks** C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
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- Brackets ()** Brackets around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
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ecf meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Sig. figs. Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.

Arithmetic errors

Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.

Transcription errors

Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.

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1 (a) rule alongside spring B1

set zero at one end and read scale at other end
OR take scale reading at each end and subtract B1

extra valid detail, e.g. rule close to and parallel with spring, use of marker/set-square, eye level with reading etc. B1

(b) 3 **OR** 3.0 (cm) B1

(c) 0.8 (N) ignore negative sign B1
 up(wards), accept arrow upwards B1

[Total: 6]

2 (a) 5000 (g) B1

(b) density = mass / volume in any form **OR** (volume =) mass / density C1
 5000 / 7.81 **OR** 5 / 7.81 **OR** 0.64, ecf from (a) C1
 640 (cm^3), accept 6.4×10^{-4} if clearly stated in m^3 A1

[Total: 4]

3 (a) force (exerted), distance (moved), either order B1 + B1
 time (taken) B1

(b) energy lost/wasted/transferred (to surroundings) **OR** inefficiency B1
 suitable cause for energy lost e.g. friction, heat, sound, moving parts B1

[Total: 5]

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- 4 (a) (i) temperature (of solid) rising **OR** (solid) expanding
NOT any indication of melting/turning into liquid,
accept particles gain k.e./vibrate more B1
- (ii) melting owtte B1
- (iii) temperature of liquid rising **OR** liquid expanding
accept liquid particles gain k.e./move faster/more B1
- (b) ice needs (thermal) energy/heat to melt/overcome intermolecular forces
takes this energy from drink M1
- (c) (i) (temperature) increases/gets hotter
steam transfers thermal energy/heat/supplies energy (to water), accept
steam loses (latent) heat (as it condenses) M1
- (ii) increases
steam condenses/turns into water **OR** gas molecules become liquid
molecules A1
- [Total: 9]**
- 5 (a) echo **OR** sound reflected (from rock face) B1
- (b) speed = distance/time in any form **OR** (distance =) speed × time
 330×1.8 **OR** 330×0.9 **OR** 594
297 (m) accept 2 or 3 sig. figs. C1
- (c) 0.9 (s) C1
- (d) any two from:
(sound is) longitudinal/light is transverse
(sound) travels more slowly/light travels faster
(sound) has lower frequency/longer wavelength accept reverse for light
(sound) cannot travel through a vacuum/light can travel in a vacuum
(sound is a) mechanical/pressure wave **OR** is not electromagnetic/light is
electromagnetic A1
- B2**
- [Total: 7]**

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6 (a) (i) rub rod with cloth B1

(ii) any suitable test,
e.g. picks up/attracts paper, hair, stream of water etc. **OR** using electroscope
OR attracts/repels an object known to be charged B1

(b) any two from:
friction/rubbing (between clothing and seat)
lady becomes charged
discharged when touches handle, accept charge travels through/to/from lady
(from/to handle)/charge is earthed B2

[Total: 4]

7 (a) (i) a line between F_2 or F_1 and C ± 3 mm C1
a line between F_2 or F_1 and C ± 1 mm A1

(ii) refraction either at centre line **OR** at both surfaces,
parallel after lens **OR** reaches tip of image B1
B1

(b) bottom box ticked: at I B1

(c) (i) closer to F_1 /C/lens/ F_2 **NOT** closer to object B1
(ii) smaller/reduced/diminished B1

[Total: 7]

8 (a) (i) variable resistor B1

(ii) adjust/change/vary/control the current/voltage, ignore vary resistance B1

(b) (i) top box ticked: charge B1

(ii) A or amp(s) or ampere(s), condone a, ignore I, NOT ammeter B1

(c) ($R =$) $R_1 + R_2$ **OR** $8 + 12$ C1
 $20 (\Omega)$ A1

(d) (i) R_1 and R_2 clearly shown in parallel (between X and Y)
rest of circuit including R_1 and R_2 correct
note: short circuit across resistors loses both marks M1
A1

(ii) parallel B1

[Total: 9]

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- 9 (a) (i)** core B1
- (ii) iron **NOT** steel, accept ferrite B1
- (b)** $V_1/V_2 = N_1/N_2$ in any form C1
correct substitution C1
250 A1
- (c)** reduced brightness/dimmer M1
fewer (than 250) turns A1
lower voltage, accept smaller/lower current A1
- (d)** lamp would blow/burn out B1
accept blow up/glow extremely

[Total: 9]

- 10 (a)** electrons B1
- (b)** glows or equivalent e.g. (spot of) light/fluorescence B1
- (c) (i)** H₁ and H₂ both, either order B1
(ii) A and C both, either order B1
(iii) Y₁ and Y₂ both, either order B1
- (d) (i)** Y₂ **OR** top } both B1
(ii) Y₁ **OR** bottom }

[Total: 6]

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11 (a) (i) B B1

(ii) A } both correct B1
 (iii) C }

(b) 3 B1

(c) $\frac{2}{1}$ (any attempt at a symbol) B1
 $\frac{3}{1}$ (any attempt at a symbol) B1

[Total: 5]

12 (a) all 5 points plotted $\pm \frac{1}{2}$ small square -1 e.e.o.o. B2

smooth best-fit single line curve through most of the points, not joining points dot to dot B1

(b) (i) half/50%/0.5/ $\frac{1}{2}$ B1

(ii) indication of correct use of graph B1

idea of halving, e.g. 175 or mark at 175 on graph, **NOT** halving number of days, i.e. 7 C1

3.4 – 4.0, accept nearest integer from candidate's graph A1

(iii) 1. candidate's **(ii)** **OR** integer either side of candidate's **(ii)** M1

2. half-life not affected by sample size/startling point
accept idea that half-life does not change. A1

[Total: 9]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
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MARK SCHEME for the October/November 2014 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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Sig. figs. Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme. Rounding errors in the second or third significant figure will be penalised.

Arithmetic errors

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Units Deduct one mark for an incorrect or missing unit, but only if the answer would otherwise have gained all the marks available for that answer. Maximum one unit penalty per question.

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- 1 (a) A increasing speed
 B constant speed
 C stationary
 Note: one mark lost for e.e.o.o.
- B2

- (b) D increasing acceleration
 E constant acceleration
 F constant speed
 Note: one mark lost for e.e.o.o.
- B2

(c) (i) $(a =) \Delta v/t$ OR $(v-u)/t$ OR $10.5/1.5$
 $= 7.0 \text{ m/s}^2$

C1
A1

(ii) $(a =) 0 (\text{m/s}^2)$

B1

- (iii) upward and downward forces equal OR no resultant force
 OR forces equal and opposite OR forces balanced
 OR weight (of body) = tension (in rope)
- B1

[Total: 8]

- 2 (a) (i) (increase in g.p.e. = mgh OR $65 \times 10 \times 8 =$) 5200 J
- B1

(ii) EITHER
 k.e. gained = g.p.e. lost
 $\frac{1}{2}mv^2 = 5200$ in any form
 $v^2 = 5200/(0.5 \times 65)$ OR 160
 $v = 12.6 \text{ m/s}$ e.c.f. (a)(i)
 OR
 $v^2 = u^2 + 2as/v^2 = 2gh$
 $v^2 = 2 \times 10 \times 8$
 $v^2 = 160$
 $v = 12.6 \text{ m/s}$ e.c.f. (a)(i)

C1
C1
C1
A1
(C1)
(C1)
(C1)
(A1)

- (b) speed is the same
 EITHER
 loss in g.p.e. is the same
 k.e. gained is the same
 OR
 acceleration is the same
 distance fallen is the same
- B1
B1
B1
(B1)
(B1)

[Total: 8]

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- 3 (a) (i) force / pressure greater on outside surface owing to air pressure
B1
 (ii) $p = F/A$ in any form **OR** ($F = pA$)
 $= (1.0 \times 10^5 - 6000) \times 0.12$
 11280 N to at least 2 sig. figs.
C1
C1
A1

- (b) (i) pressure of oil = pressure of water
B1
 (ii) 1. $(p =) h\rho g$
 $(= 0.25 \times 1000 \times 10 =) 2500 \text{ Pa}$
C1
A1
 2. $h\rho g = 2500$
 $(\rho = 2500 / (0.32 \times 10) =) 781 \text{ kg/m}^3$ to at least 2 sig. figs.
C1
A1

[Total: 9]

- 4 (a) mass of block m
initial temperature θ_1 and final temperature θ_2
time of heating t
voltage/p.d. V AND current I
B1
B1
B1
B1

- (b) $(c =) VIt / [m(\theta_2 - \theta_1)]$
OR $Pt / [m(\theta_2 - \theta_1)]$ **OR** $E / [m(\theta_2 - \theta_1)]$ as appropriate to symbols defined in (a)
 numerator correct
denominator correct
B1
B1

- (c) (more) thermal energy/heat lost (to surroundings) so temperature rise is less
OR more thermal energy/heat input required for same temperature rise
B1

[Total: 7]

- 5 (a) (i) longitudinal: oscillations/vibration of particles/molecules in direction of travel
 (of wave)
 transverse: oscillation/vibrations of particles/molecules perpendicular to
 direction of travel (of wave)
B1
B1
 (ii) 1. e.g. sound wave / compression wave on a spring
 2. e.g. any named electromagnetic wave / ripples / water wave / wave on a
 stretched rope
B1
B1

- (b) use of $v = f\lambda$ in any form **OR** ($\lambda =) v/f$ **OR** $7200/30$ **OR** $7.2/30$
 $240 \text{ m} / 0.24 \text{ km}$
C1
A1

- (c) no sound heard/quieter sound
 medium/air required to transmit sound
OR sound does not travel through a vacuum
B1
B1

[Total: 8]

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- 6 (a) (i) 1. one normal to mirror drawn
2. angle of incidence, labelled X
- (ii) 1. both reflected rays drawn
2. construction lines to locate image, marked I

- (b) (i) dot marked C in correct position
- (ii) two circular arcs each joining correct points on barrier
spacing of arcs same as spacing of incident waves

[Total: 7]

- 7 (a) (i) diagram showing:
molecules widely spaced
molecules randomly positioned
- (ii) (attractive) forces (much) smaller between gas molecules
gas molecules (much) farther apart

- (b) (i) $pV = \text{constant}$ OR $p_1V_1 = p_2V_2$ OR ($V_2 =$) p_1V_1/p_2
 OR ($V_2 =$) $2.75 \times 10^6 \times 6 \times 10^{-3} / 1.1 \times 10^5$
 $= 0.15 \text{ m}^3$
 (no. of balloons = $(0.15 - 6 \times 10^{-3}) / 3 \times 10^{-3} = 48$)
- (ii) pressure of air in balloon increases
molecules move faster OR hit balloon surface harder/more often
OR larger force rips/breaks rubber OR balloon expands

[Total: 9]

- 8 (a) (i) rectifier/diode
- (ii) frequency (of A.C. supply)
- (b) (i) ($P =$) IV OR 0.5×5.3 OR 500×5.3
 2.6 W OR 2600 mW
- (ii) ($E =$) Pt OR IVt OR $2.65 \times 1.5 \times 3600$ OR $0.5 \times 5.3 \times 1.5 \times 3600$
 14000 J

- (c) energy only underlined

[Total: 7]

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9 (a) background (radiation) **OR** a specific source of background radiation e.g. rocks/
building materials/radon gas/cosmic rays B1

- (b)** any three from:
low count rate due to background radiation only
slightly less reading due to random nature of radioactivity
very high reading due to α -particles **OR** emission from source
sudden increase of count rate at limit of range of α -particles B3

- (c) (i)** downward curve B1
(ii) (count rate) decreases/background only
deviation starts at start of plates B1
B1

[Total: 7]

10 (a) (lamps) stay on/have same brightness as before/nothing happens B1
(lamps) still connected to supply/have same voltage as before/are connected in parallel B1

- (b) (i)** line 1: on line 2: off line 3: off line 4: on B2
deduct one mark for e.e.o.e.
(ii) when either switch is operated, the state of the lamp changes. B1

[Total: 5]

11 (a) (i) electromagnetic induction B1

- (b) (i)** pointer deflects
pointer returns to zero B1
B1
(ii) greater deflection (of pointer)
pointer deflects in opposite direction and returns to zero
OR deflects for shorter time B1
B1

[Total: 5]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

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- c.a.o. means "correct answer only".
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- Brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
- Underlining indicates that this must be seen in the answer offered, or something very similar.
- OR / or indicates alternative answers, any one of which is satisfactory for scoring the marks.
- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.
- Significant figures Answers are acceptable to any number of significant figures ≥ 2 , except if specified otherwise, or if only 1 sig. fig. is appropriate.
- Units Incorrect units are not penalised, except where specified. More commonly, marks are allocated for specific units.
- Fractions These are only acceptable where specified.
- Extras Ignore extras in answers if they are irrelevant; if they contradict an otherwise correct response or are forbidden by mark scheme, use right + wrong = 0.
- Ignore indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.
- Not/NOT indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

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- 1 (a) (speed =) distance/time in words, symbols or numbers C1
 $(37.1 - 2.1 =) 35$ C1
 $35/7$ C1
 $5(.0)$ (cm/day) A1
- (b) (i) 3 points correctly plotted to $\frac{1}{2}$ square B2
 (ii) (vertical) spacing not uniform/equal OR points not on a straight line
 OR points do not line up OR difference in gradients between points B1
- [Total: 7]**
- 2 (a) increase/change/difference in length OR new length – original length
 OR amount/length/distance it stretches B1
- (b) (i) 1. 2 seen OR used C1
 $11(.0)$ (cm) A1
 2. 0.8 (cm) B1
 (ii) $W = m \times g$ in words, symbols or numbers
 OR correct conversion used, e.g. $1\text{kg} = 10\text{N}$ C1
 $200\text{g}/0.2\text{kg}$ A1
- [Total: 6]**
- 3 (a) bright specks OR spots/dots OR flashes of light B1
 moving randomly OR jerky movements OR zig zag/jiggling B1
- (b) line representing a smoke particle moving with a change of direction B1
 line is straight with at least 2 changes of direction B1
- (c) collisions/bombardment B1
 (with) air atoms/molecules/particles B1
- (d) Brownian B1
- [Total: 7]**

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4 (a) greater pressure from man **OR** man will fall through ice **OR** ice will break/crack B1

(b) idea of increasing area **OR** spreading load M1

any three from:
 larger (surface) area
 load/weight/force more spread out
 less pressure
 use of $P = F/A$ A3

[Total: 5]

5 (a) 74 ($^{\circ}\text{C}$) B1

(b) any three from:
 particles move further apart/heating causes expansion
 warm air less dense **OR** cold air more dense
 hot air rises **OR** cold air falls
 convection (current) B3

(c) moves/goes down (tube) **OR** gives a lower reading B1

contracts/decreases in volume/shrinks B1

(d) any indication between $-10\text{ }^{\circ}\text{C}$ and centre of bulb B1

[Total: 7]

6 (a) (i) i and r both clearly correct B1

(ii) $i = r$ B1

(iii) seeing over/around an obstacle B1

(iv) image/ray moves/misses eye **OR** viewer can no longer see image/ray/anything **OR** viewer sees inside of tube **OR** angle of incidence/reflection changes B1

(b) (i) 2 focal lengths indicated B1

(ii) ray parallel to axis **AND** emergent ray goes through F1 B1

refraction shown at centre line **OR** at each surface B1

(iii) incident ray through principal focus **AND** emergent ray parallel to axis B1

[Total: 8]

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- 7 (a) (milli)ammeter **OR** galvanometer **NOT** ampmeter B1
- (b) (i) nothing/stays the same/half-way B1
- (ii) nothing/stays the same/half-way B1
- (iii) nothing/stays the same/half-way B1
- (iv) it/arrow/pointer moves/goes/flicks **OR** current changes M1
left and right **OR** backwards and forwards A1
- (c) generator **OR** dynamo **OR** microphone B1

[Total: 7]

- 8 (a) (i) nothing/zero/0 B1
- (ii) $V = IR$ or V/R in words, symbols or numbers C1
6/10 C1
0.6 A1
A **OR** amp(s) **OR** ampere(s) B1
- (iii) candidate's (a)(ii) B1

- (b) (i) variable resistor **OR** rheostat

OR potential divider B1

- (ii) neat, correct circuit with one added component in series with lamp B1

correct symbol for variable resistor B1



[Total: 9]

- 9 (a) idea of points to north (pole of Earth) M1
- when freely suspended/floating on water A1
- OR**
- repels (M1)
- a (known) N pole (A1)

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- (b) (i) repulsive/repel B1
 (ii) repulsive/repel B1
 (iii) attractive/attract B1
- (c) (i)

S	N
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 B1
 (ii) attractive/attract B1
 (iii) attractive/attract B1

[Total: 8]

- 10 (a) iron B1

- (b) $V_1/V_2 = N_1/N_2$ in words, symbols or numbers C1
 correct substitution C1
 12 (V) A1

[Total: 4]

- 11 (a) alpha OR α B2
 beta OR β
 gamma OR γ

in any order
 if two correct, 1 mark

- (b) (i) beta OR β B1

- (ii) alpha OR α B1

- (iii) alpha OR α B1

- (c) (i) 2 B1

- (ii) evidence of number of atoms halved twice B1

- 6×10^{10} B1

- (iii) candidate's (c)(ii) B1

[Total: 9]

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12 (a) 17 B1

(b) 20 B1

(c) 17 B1

[Total: 3]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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- M marks are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
- C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
- A marks A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. An A mark following an M mark is a dependent mark.
- Brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10(J) means that the mark is scored for 10, regardless of the unit given.
- Underlining indicates that this must be seen in the answer offered, or something very similar.
- OR/or indicates alternative answers, any one of which is satisfactory for scoring the marks.
- e.e.o.o. means "each error or omission".
- o.w.t.t.e. means "or words to that effect".
- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction or thermistor/transistor/transformer.
- Not/NOT indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.
- Ignore indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
- ecf meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a

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candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Significant figures

Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.

- Units** Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.
- Fractions** Allow these only where specified in the mark scheme.

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- 1 (a) (i) (liquid) has a uniform expansion/expands at a constant rate/expands evenly/expands linearly B1
- (ii) any two from:
 larger bulb/wider/longer bulb
 more liquid
 narrower capillary/tube
 use liquid with greater expansion B2
- (iii) thermometer must be longer B1
- (b) any 2 from:
 resistance/conductance of a metal/wire/conductor/thermistor
 voltage/current of a thermocouple
 volume/pressure/expansion/contraction of a gas
 colour of a metal
 amount of radiation OR frequency OR wavelength of radiation from a metal/furnace
 colour/arrangement of liquid crystals
 expansion of a solid/any dimension of a solid
 bending of a bimetallic strip B2

[Total: 6]

- 2 (a) (density =) mass/volume B1
- (b) water used in measuring/graduated cylinder B1
 volume of water known or read/recording/taken B1
 place the coins in the water and read/record/take new level of water in cylinder B1
 subtract readings B1
 OR ALTERNATIVE METHOD:
 pour water into displacement can to level of spout (B1)
 place the coins/several coins in the water (B1)
 collect overflow (B1)
 measure volume of overflow water using measuring graduated cylinder (B1)
 measure mass/weigh the coins used with balance/spring balance B1

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- (c) one from:
 read measuring cylinder levels at bottom of meniscus
 repeat volume measurement and find average
 place eye level with surface in measuring cylinder (to avoid parallax error)
 place coins one at a time to avoid air bubbles between coins
 avoid splashing when adding coins to water
 make sure coins are dry/clean
 use narrow/small measuring cylinder
 place containers on horizontal surface
 check zero of balance/spring balance/scales
 displacement can method: make sure dripping finishes before and after adding coins B1

[Total: 7]

3 (a) Fd OR weight $\times d$ OR mgh OR $30\ 000 \times 10 \times 140$ OR 4.2×10^7 seen anywhere C1

$(P =) E/t$ OR W/t OR mgh/t symbols or words C1

$4.2 \times 10^7 / 60$ C1

7.0×10^5 W/700 kW/0.7 MW A1

(b) efficiency = output/input OR $(P_{in} =) 100 \times P_{out} / \text{efficiency}$ C1

$(P_{in} =) 100 \times 7 \times 10^5 / 70$ C1

1.0×10^6 W OR 1 000 000 W OR 1.0 MW A1

(c) (horizontal) wind has no effect on P.E gained/vertical force on water
 OR same upward/vertical force acts on water
 OR force from wind is horizontal B1

[Total: 8]

4 (a) 2 lines at 90° to each other of same length labelled 30 N or 6 cm B1

both lines 6.0 ± 0.2 cm. B1

arrows on the two lines drawn, either head to tail
 OR a complete square shown with diagonal and arrows on adjacent sides B1

resultant in range 40–45 N B1

(b) (vertically) upwards B1

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- (c) same as value in (a), only if answer to (a) is a force
OR 40–45 N

B1

[Total: 6]

- 5 (a) (i) ($W = mg = 1440 \times 10 = 14\,400 \text{ N}$)

B1

- (ii) ($P = F/A$ OR $14\,400 / (1.5 \times 1.2)$)

C1

8000 Pa OR N/m^2

A1

- (b) (i) ($P = h\rho g$ OR $1.4 \times 1000 \times 10$)

C1

14 000 Pa OR N/m^2

A1

- (b) (ii) pressure on base of P smaller/Q greater

M1

(with same volume removed) smaller decrease in depth in Q
OR height in Q is greater

A1

[Total: 7]

- 6 (a) (molecules) move in random directions/randomly/with constant random motion/zig-zag motion/in all directions

B1

(molecules) have random speeds OR a range of speeds OR move (very) fast/at (very) high speed

B1

any 1 from:

(molecules) collide with each other

(molecules) move in straight lines between collisions

(molecules) change direction in collisions

(molecules) collide with walls (of cylinder)

B1

- (b) (i) pressure increases

M1

more frequent collisions between molecules and walls

OR molecules collide with walls more often/at greater rate

A1

- (ii) $pV = \text{constant}$

OR $p_1 V_1 = p_2 V_2$ in any form

OR $1.0 \times 10^5 \times 500 = p_2 \times 240$

C1

$2.1 \times 10^5 \text{ Pa}$ to 2 or more sig. figs

A1

[Total: 7]

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- 7 (a) (a liquid evaporates) at any temperature/below the boiling point/over a range of temperatures/below 100 °C/at different temperatures/not at a fixed temperature B1
- (during evaporation) vapour forms at/escapes from the surface of the liquid B1
- (without a supply of thermal energy,) evaporation continues/occurs/doesn't stop OR causes liquid to cool/is slower/reduces B1
- (b) (i) $(Q =) mL$
OR $0.075 \times 2.25 \times 10^6$ C1
- $1.7 \times 10^5 \text{ J}$ A1
- (ii) $(E =) VIt$ OR $240 \times 0.65 \times (20 \times 60)$
OR $P = IV$ and $P = E/t$ OR energy/time C1
- $1.9 \times 10^5 \text{ J}$ A1
- (iii) energy is transferred to the surroundings
OR in heating the surroundings/air/atmosphere/hot-plate B1

[Total: 8]

- 8 (a) speed of sound in gas: 300 m/s B1
- speed of sound in solid: 3000 m/s B1
- (b) particles / molecules / atoms oscillate / vibrate
OR pressure variation / compressions / rarefactions / displacements move B1
- in the direction of travel (of the wave / sound) B1
- (c) (i) two complete wavelengths / cycles with shorter wavelength B1
- wave drawn has greater amplitude B1
- (ii) higher frequency / pitch B1
- louder / higher volume B1

[Total: 8]

- 9 (a) (i) $(I =) V/R$ OR $6/(12 + 4)$ OR $6/16$ C1
- $0.38 \text{ A}/0.37 \text{ A}$ A1

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(ii) $1/R = 1/R_1 + 1/R_2$
 OR ($R = R_1 R_2 / (R_1 + R_2)$)
 OR above with numbers substituted

C1

$$R = 3 \text{ } (\Omega)$$

C1

$$(I = 6/3 =) 2(0.0) \text{ A}$$

A1

OR ALTERNATIVE METHOD:

$$6/12 \quad (\text{C1})$$

$$+ 6/4 \quad (\text{C1})$$

$$2(0.0) \text{ A} \quad (\text{A1})$$

(b) (i) $R \propto l$ (in words or symbols)
 OR directly proportional OR e.g. R doubles when l doubles

B1

(ii) $R \propto 1/A$ (or with words)
 OR inversely proportional OR e.g. R doubles when A halves

B1

(c) 4/12 OR 4:12 OR 1/3 OR 1:3 OR 0.33

B1

[Total: 8]

10 (a) slip-rings (and brushes)

B1

(b) (i) sinusoidal curve, any value at $t = 0$

B1

(ii) appropriate T value indicated on graph

B1

(iii) smaller T /time of one cycle OR higher frequency

B1

higher maximum current/greater amplitude/higher peaks/higher peak-to-peak

B1

(c) diode/rectifier

B1

[Total: 6]

11 (a) γ : none/zero/0/neutral AND
 2 cm (or more) of lead/thick lead/50 cm (or more) of concrete

B1

β : particle/electron AND
 any named metal/glass/concrete OR 1 m of air

B1

α : particle/helium nucleus/2 protons + 2 neutrons/ ${}^4_2\text{He}/{}^4_2\alpha$ AND
 positive OR + OR +2

B1

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(b) (i) 38

(ii) 90

(iii) 52

(iv) 38

B3

(c) 36 hours = 3 half-lives

OR halving in steps from 4800 to 600 seen

C1

half-life = 12 hours OR 3 half-lives OR 2/3 of 36

C1

(further time to reduce to 150 Bq =) 24 (hours)

A1

[Total: 9]

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MARK SCHEME for the October/November 2013 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.
- Significant figures Answers are acceptable to any number of significant figures ≥ 2 , except if specified otherwise, or if only 1 sig. fig. is appropriate.
- Units Incorrect units are not penalised, except where specified. More commonly, marks are allocated for specific units.
- Fractions These are only acceptable where specified.
- Extras Ignore extras in answers if they are irrelevant; if they contradict an otherwise correct response or are forbidden by mark scheme, use right + wrong = 0.
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Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	21

- 1 (a) (i) 7 minutes 20 seconds B1
- (ii) 440 (s)
division by 40
11 (s) C1
C1
A1
- (b) (speed =) distance/time in any form C1
75/15 C1
5 (m/s) A1
Note: 6.8 (m/s) gains 2 marks as correctly using time 11(s) from (a)
- [Total: 7]
- 2 (a) ($D =$) mass/volume C1
476/35 C1
13.6 OR 13 600 A1
 g/cm^3 OR kg/m^3 B1
note: if value calculated, unit must agree with value)
- (b) top box ticked (mass of water is less than mass of mercury) B1
- (c) (i) middle box ticked (stays the same) B1
(ii) top box ticked (decreases) B1
- [Total: 7]
- 3 (a) turning effect OR force \times distance (between force and pivot) B1
- (b) (i) equal (magnitude) accept the same size/balanced B1
note: no turning effect is insufficient
opposite direction B1
note: CW moment = ACW moment scores both marks
- (ii) 1. at pivot (however expressed) e.g. idea of where plank in contact with log B1
2. upwards accept up, vertically is insufficient B1
- [Total: 5]

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	21

- 4 (a) number of (complete) vibrations/oscillations/waves per second/unit time
note: rate of oscillations/vibrations scores both marks M1 A1

- (b) (i) particles/air/solid vibrates/is moved OR prongs push/collide with air molecules reference to/idea of (sound) waves idea of pressure/longitudinal/compressions/rarefactions (transmitted through air) B1 B1 B1
- (ii) amplitude decreases o.w.t.t.e. e.g. smaller vibration of prongs NOT slower vibrations / frequency decreases / less vibrations B1
- (iii) pitch lower pitch / octave lower ignore lower/less sound NOT louder/quieter C1 A1

[Total: 8]

- 5 (a) thermometer B1

- (b) reduce heat loss/transfer accept keeps heat in/insulates B1

- (c) balance OR scales, condone scale / weighing machine, accept measuring cylinder find mass of empty beaker/container/apparatus, accept measure volume of water find mass of beaker/container/apparatus + water, accept look up density of water subtract the two masses, accept use $M = D \times V$ B1 B1 B1 B1
note: allow weight/weigh instead of mass, ignore if subtraction gives negative mass

- (d) bubbles (ignore “of air”) (water) vapour accept “steam” or equivalent temperature/thermometer reading stops rising level of water decreases ignore evaporation } any 2 B2

[Total: 8]

- 6 (a) (i) refraction accept refracted ray, ignore bends B1

- (ii) 45 ($^{\circ}$) condone no/incorrect unit B1

- (b) (i) refracted down at first surface refracted down at 2nd surface B1 B1

- (ii) X marked above point where candidate’s blue light hits screen B1

[Total: 5]

Page 5	Mark Scheme IGCSE – October/November 2013	Syllabus 0625	Paper 21
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- 7 (a) (i) focal length indicated ± 0.2 cm B1
 (ii) either principal focus clearly indicated B1
- (b) diminished B1
 inverted B1
 image distance less B1
- (c) any correct ray with appropriate refraction either at centre line or at both surfaces B1

[Total: 6]

- 8 (a) clockwise from top:
 right B1
 left B1
 right OR accept left if top compass is left B1
 sloping away from letter N any angle from  up to  B1

- (b) no effect B1
 no effect B1
 attracts B1
 attracts B1

[Total: 8]

- 9 (a) resistor B1
 (b) (i) 6.0 V OR 6V, unity penalty applies B1
 (ii) 6.0 V OR 6V, unity penalty applies unless penalised in (i), no e.c.f. from (i) B1
 (iii) 250 mA OR 0.25 A, unit penalty applies unless penalised in (i) or (ii) B1
- (c) ($R =$) V/I C1
 6/0.25 OR 6/250 C1
 24 OR 0.024 A1
 Ω OR ohm(s) OR $k\Omega$ (note: if value calculated, unit must agree with value) B1

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	21

- (d) (i) decreases B1
 (ii) increases B1
 (iii) unchanged B1
 accept no effect/none
- [Total: 11]**

- 10 (a) motors correctly connected in parallel across output B1
 (b) $V_1/V_2 = N_1/N_2$ in any form C1
 suitable substitution e.g. $18/240 = N_1/4800$ C1
 360 A1
 (c) will run at reduced speed NOT will not work B1
 accept will work/turn slowly
- [Total: 5]**

- 11 (a) (i) 210 and 122 and 72 B1
 (ii) 40–60 (s) C1
 45–55 (s) A1
 (b) background (radiation) OR any suitable example of background radiation B1
 accept radiation in the environment
- [Total: 4]**

- 12 (a) 84 B1
 (b) 128 B1
 (c) (i) 84 or candidate's (a) B1
 (ii) orbits OR shells OR outside nucleus B1
 (d) 208 B1
 82 B1
- [Total: 6]**

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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Page 2	Mark Scheme IGCSE – October/November 2013	Syllabus 0625	Paper 31
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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

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- B marks are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.
- A marks In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.
- C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
- Brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
- Underlining indicates that this must be seen in the answer offered, or something very similar.
- OR / or indicates alternative answers, any one of which is satisfactory for scoring the marks.
- e.e.o.o. means "each error or omission".
- o.w.t.t.e. means "or words to that effect".
- Spelling Be generous about spelling and use of English. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction/thermistor/transistor/transformer.
- Not/NOT indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.
- Ignore indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
- e.c.f. means "error carried forward". This is mainly applicable to numerical questions, but may occasionally be applied in non-numerical questions if specified in the mark scheme. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by e.c.f. may be awarded, provided the subsequent working is correct.

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	31

Significant Figures

Answers are normally acceptable to any number of significant figures ≥ 2 . Any exceptions to this general rule will be specified in the mark scheme.

Units Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question.

Arithmetic errors

Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one.

Transcription errors

Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly.

Fractions Only accept these where specified in the mark scheme.

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	31

- 1 (a) extension (of spring) proportional to load/force (applied)
 OR load/force (applied) proportional to extension
 OR force = constant × extension
 OR extension = constant × force
 OR $F = kx$ in any form with symbols explained B1

- (b) (i) graph is through the origin AND is a straight line/has a constant gradient B1
 (ii) $F = kx$ in any form OR $(k =) F/x$
 use of a point anywhere on graph e.g. 50/20
 2.5 N/mm OR 2500 N/m C1
C1
A1
 (iii) from 50 mm extension, graph curves with no negative gradient B1
 (iv) straight line through origin with smaller gradient than graph shown finishing at more than 50 mm B1

[Total: 7]

- 2 (a) (i) $v = u + at$ OR $(a =) (v - u)/t$ OR $24 = a \times 60$ OR $24/60$
 $0.4(0)\text{m/s}^2$ C1
A1
 (ii) $(F =) ma$ OR $7.5 \times 10^5 \times 0.40$
 300 000 N OR 300 kN C1
A1

- (b) (i) in words or symbols ($P =) W/t$ OR $F \times d/t$ OR Fv
 $OR 7.2 \times 10^4 \times 24 / 1$ OR $7.2 \times 10^4 \times 24$
 $1.7 \times 10^6 \text{W}$ C1
A1
 (ii) gravitational/potential energy of train has to be increased
 OR force acts down the slope/backward force acts (on train) B1
 (for the same distance moved) more work done has to be done OR energy
 has to be provided (by the engine)
 in the same time (so needs more power) B1
B1

[Total: 9]

- 3 (a) (i) 3 appropriate examples: e.g. spanner, scissors, tap etc. –1e.e.o.o. B2
 (ii) there is a resultant force OR more force down than up
 there is a resultant moment OR clockwise moment is not equal to anticlockwise moment B1
B1

- (b) (i) $F \times 0.5 = 12 \times 0.3$
 7.2 N C1
A1
 (ii) weight has no moment about centre of rod/has no perpendicular distance from centre of rod
 OR weight acts at centre of rod/pivot/centre of mass B1

[Total: 7]

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	31

- 4 (a) (i) (gravitational) potential energy to kinetic energy B1
 (ii) chemical energy to (gravitational) potential energy B1
 reference in (i) or (ii) to heat/thermal/internal energy produced OR work done against air resistance or friction B1

(b) (i) (K.E. =) $\frac{1}{2}mv^2$ OR $0.5 \times 940 \times 16^2$
 $1.2 \times 10^5 \text{ J}$ C1
 A1

(ii) in words or symbols $Q = mc\theta$ OR $\theta = Q/mc$
 $1.203 \times 10^5 = 4.5 \times 520 \times \theta$ OR $\theta = 1.203 \times 10^5 / (4.5 \times 520)$
 51°C or K C1
 C1
 A1

[Total: 8]

- 5 (a) (i) heated air/warm air rises/moves up (not sideways) B1
 (ii) air (between plate and hands) is a poor conductor/does not conduct B1

(b) left hand/palm (facing matt black side gets hotter)
 OR hand facing matt black side (gets hotter)
 matt black side is a better emitter/radiator (of heat than shiny side) B1
 B1

(c) conduction takes place B1
 copper a good conductor/conduction is rapid/heat flows to equalise temperature B1

[Total: 6]

- 6 (a) molecules OR atoms OR particles
 speed OR velocity OR kinetic energy
 molecules OR atoms OR particles
 (Surface) area
 any four correct gains 2 marks, two or three correct gains 1 mark B2

(b) (i) (when cap is screwed on) at top of mountain:
 pressure of air in bottle = the low pressure of the air outside
 OR is less than pressure at bottom of mountain
 OR is low B1

(at bottom of mountain) bottle collapses because pressure outside (bottle) is greater than pressure inside B1

(ii) Boyle's law applies OR $PV = \text{constant}$ OR $P_1V_1 = P_2V_2$
 $9.2 \times 10^4 \times V = 4.8 \times 10^4 \times 250$
 130 cm^3 C1
 C1
 A1

[Total: 7]

Page 6	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	31

- 7 (a) (i) diffraction B1
- (ii) waves travel slow(er)/water is shallow(er) B1
- (iii) angular spread of wavefronts increases o.w.t.t.e.
OR amplitude of waves is smaller B1
- (b) (i) oscillation/up and down motion (of rope) is at right angles to the direction of the wave
OR motion of rope/particles is at right angles to the direction of the wave B1
- (ii) $\lambda = 2.4/2 = 1.2 \text{ m}$ C1
 $v = f\lambda$ in any form OR $(f =) v/\lambda$ OR $3.2/1.2$ C1
 2.7 Hz A1
OR
 $t = 2.4/3.2$ (C1)
 $f = 2 \times 3.2/2.4$ (C1)
 2.7 Hz (A1)

[Total: 7]

- 8 (a) circuit with solenoid AND galvanometer or ammeter or voltmeter B1
- magnet labelled OR poles shown, with any orientation, near solenoid OR inside solenoid B1
appropriate action described e.g. move magnet/solenoid B1
- (b) (i) magnetic field (in core)
(magnetic field is) alternating/changing/reversing M1
A1
- (ii) same frequency a.c. ticked B1
- (iii) $V_S/V_P = N_S/N_P$ in any form OR $(V_S =) 12 \times 200/50$ OR 48 (V) C1
 $V_S I_S = V_P I_P$ in any form OR with numbers C1
 $(I_S =) 12 \times 0.50/48 = 0.12 \text{ A}$ OR 0.13 A A1
OR
 $I_S/I_P = N_P/N_S$ in any form (C2)
 $(I_S =) 0.5 \times 50/200 = 0.12 \text{ A}$ OR 0.13 A (A1)

[Total: 9]

- 9 (a)(i)(ii) $R \propto L$ in words or symbols
- (ii) AND $R \propto 1/A$ in words or symbols B1
- (b) $P = IV$ OR $(I =) P/V$ OR $60/230$ C1
 0.26 A A1

Page 7	Mark Scheme	Syllabus	Paper
	IGCSE – October/November 2013	0625	31

- (c) length change divides resistance by 2/multiplies current by 2
 cross-section change multiplies resistance by 3/divides current by 3
 (overall) resistance of Y is 3/2 times bigger/ $3/2 \times 885 \Omega / 1327 \Omega$
 OR current in Y 2/3 of $0.26 \text{ A} = 0.17 \text{ A}$
 current in Y/Current in X = 2/3

[Total: 7]

- 10 (a) between plates path curves upwards continuously
 continuation in straight line in space beyond plates

B1
B1

- (b) (i) in range 7.0 to 7.5 V
 (ii) use of the number 4 (as a distance or a time)
 $f = 1/T$ OR $\frac{1}{4}$ OR $1/0.004$ but NOT if $f = v/\lambda$ used
 250 Hz

[Total: 6]

- 11 (a) (i) input high/on/1, output low/off/0
 input low/off/0, output high/on/1
 OR reverses/inverts state of input OR output opposite to input

B1

- (a) (ii) resistance changes as temperature changes

B1

- (i) at low temperature resistance of thermistor is high
 OR when temperature falls resistance of thermistor rises
 p.d. across thermistor is high OR p.d. across R is low
 (voltage) input to gate is low
 output of gate is high (and warning light is on)

B1
B1
B1
B1

- (ii) changes the temperature/set value at which the lamp comes on

B1

[Total: 7]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0625 PHYSICS

0625/21

Paper 2 (Core Theory), maximum raw mark 80

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Page 2	Mark Scheme IGCSE – May/June 2013	Syllabus 0625	Paper 21
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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

- B marks are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen in the candidate's answer.
- M marks are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.
- C marks are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it, e.g. if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows he knew the equation, then the C mark is scored.
- A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored.
- c.a.o. means "correct answer only".
- e.c.f. means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he may be given marks indicated by e.c.f. provided his subsequent working is correct, bearing in mind his earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated "e.c.f."
- e.e.o.o. means "each error or omission".
- brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
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Page 3	Mark Scheme IGCSE – May/June 2013	Syllabus 0625	Paper 21
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- 1 (a) $15 \pm 1 \text{ cm}^3$ B1
- (b) level shown at $40 \pm 1 \text{ cm}^3$ OR 25 + candidate's (a) $\pm 1 \text{ cm}^3$ on magnified figure B1
- (c) idea of goes up further OR more sensitive
OR idea of small variations causing larger height differences
OR larger divisions / more gradations B1
- [Total: 3]**
- 2 (a) (i) $D = M / V$ in any form OR $D \times V$ C1
 2300×0.0012 C1
 2.76 OR 2.8 (kg) A1
- (ii) (mass of bricks =) 500×2.76 OR $500 \times$ candidate's (a)(i)
 (total mass =) 1480 OR e.c.f. candidate's (a)(i)
 yes / no ticked (expect yes), must be compatible with candidate's total mass C1
 C1
 A1
- (b) (i) the same because made of same material B1
 (ii) less than OR equivalent answer B1
- [Total: 8]**
- 3 (a) (frictional/tension/applied) force and newton/N B1
 distance and metre/m, centimetre/cm or correct metric unit B1
- (b) time / speed B1
- (c) (i) smaller / less / drops B1
 (ii) smaller / less / drops B1
 (iii) smaller / less / drops B1
- (d) chemical B1
- [Total: 7]**
- 4 (a) mercury/Hg OR alcohol OR named alcohol e.g. ethanol B1
- (b) vacuum OR nothing OR empty OR vapour B1
- (c) ice point indicated and labelled at 0°C
 steam point indicated and labelled at 100°C B1
 B1

Page 4	Mark Scheme IGCSE – May/June 2013	Syllabus 0625	Paper 21
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- (d) (i) moves to the right (or equivalent e.g. goes higher/up/rises) B1
(ii) liquid expands NOT thermometer/particles expands B1
[Total: 6]

5 (a) 4 (hours) OR $5\frac{1}{2}$ / 5.5 (hours) / 5 hours 30 mins B1

- (b) (i) 300 (km) B1
(ii) 30 (km) B1
(iii) 270 (km) e.c.f. (i) & (ii) B1

(c) 2 horizontal sections clearly indicated B1

(d) last section, however expressed e.g. after 6 hours
smallest slope OR smallest distance in $\frac{1}{2}$ hour B1
B1

- (e) distance \div time C1
 $300 \div 6.5$ C1
answer in range 46–46.2 A1
correct unit e.g. km/h B1
[Total: 11]

6 (a) same pressure B1

(b) 6 cm of oil greater B1

- (c) (i) 1. falls / decreases / down
2. rises / increases / up } both needed B1

- (ii) they move faster / more energetically o.w.t.t.e.
collisions more frequent/often or harder
collisions with walls/container/sides
larger force (on wall/container) } any 3 points B1 \times 3

[Total: 6]

Page 5	Mark Scheme IGCSE – May/June 2013	Syllabus 0625	Paper 21
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- 7 (a) refracting, converging B2
- (b) dispersing, refracting B2
- (c) violet accept blue/purple/mauve/indigo B1
- (d) (i) infra-red / IR B1
(ii) idea of lamp hot/emitting heat OR glass passes IR B1
[Total: 7]
- 8 (a) (i) principal focus / focal point / focus / focus point B1
(ii) PF B1
- (b) (i) rays from top of object
ray parallel to axis, to lens centre and through F
ray to P and then straight on
ray through other f.p. and then parallel } any 2 B1 × 2
Z labelled at intersection of rays (even if rays wrong) B1
(ii) correct inverted image drawn (condone no labelling) between candidate's Z and the axis and perpendicular to axis A1
(if no label, must be very clear what is image)
[Total: 6]
- 9 (a) current B1
- (b) (i) 1. $R_1 + R_2$ OR 16 + 8 C1
24 (Ω) A1
2. $V = I R$ in any form OR V / R C1
12 / 24 e.c.f. 1. C1
0.5 A1
A/amp/ampere(s) B1
- (ii) 1. 0 OR zero/nothing (ignore any unit) B1
2. 12 V B1
[Total: 9]

Page 6	Mark Scheme IGCSE – May/June 2013	Syllabus 0625	Paper 21
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- 10 (a)** rheostat/potential divider/variable resistor/potentiometer/dimmer B1
- (b) (i)** 0 (V) OR zero OR nothing B1
- (ii)** 12 (V) B1
- (c)** idea of increasing brightness as S moves from A to B
appropriate correct comment on resistance or voltage C1
A1
[Total: 5]
- 11 (a)** towards top of page B1
- (b)** indication of battery connected correctly to the bare wires B1
magnet's poles shown either side OR end OR above and below X C1
magnetic field clearly vertical and interact with conductor A1
[Total: 4]
- 12 (a)** inside positive / + / +1 B1 + B1
outside negative/ – / –1 B1 + B1
inside no charge / nothing / neutral / 0 B1 + B1
- (b) (i)** electron B1
- (ii)** electron B1
[Total: 8]

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0625 PHYSICS

0625/31

Paper 3 (Extended Theory), maximum raw mark 80

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- M marks are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent marks can be scored.
- B marks are independent marks, which do not depend on other marks. For a B mark to be scored, the point to which it refers must be seen specifically in the candidate's answers.
- A marks In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.
- C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it**. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.
- brackets () around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.
- underlining indicates that this must be seen in the answer offered, or something very similar.
- OR / or indicates alternative answers, any one of which is satisfactory for scoring the marks.
- e.e.o.o. means 'each error or omission'.
- o.w.t.t.e. means 'or words to that effect'.
- Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction / thermistor / transistor / transformer.
- Not/NOT Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.
- Ignore Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

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e.c.f. meaning ‘error carried forward’ is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions.

This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated e.c.f.

Significant Figures

Answers are normally acceptable to any number of significant figures ≤ 2 . Accept answers that round to give the correct answer to 2 s.f. Any exceptions to this general rule will be specified in the mark scheme.

Units Deduct one mark for each incorrect or missing unit from a final answer that would otherwise gain all the marks available for that answer: maximum 1 per question.

Arithmetic errors

Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one.

Transcription errors

Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly.

Fractions e.g. $\frac{1}{2}$, $\frac{1}{4}$, $1/10$ etc. are only acceptable where specified.

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- 1 (a) (density =) mass/volume OR mass per unit volume
OR m/V with symbols explained B1
- (b) (i) (vol =) mass/density OR $60.7/2.70$
 $= 22.48 \text{ cm}^3$ to 2 or more sig. figs C1
A1
- (ii) $V = A \times (\text{average}) \text{ thickness}$ OR thickness = V/A
OR $22.48 / (50 \times 30)$
 0.01499 cm to 2 or more sig. figs. e.c.f. (b)(i) C1
A1
- (c) (i) micrometer/screw gauge / (vernier/digital) callipers B1
- (ii) check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet B1
- measure thickness of sheet in different places
OR measure thickness of several pieces together
calculate/obtain average thickness OR divide answer by number of measurements/pieces/places B1
B1
- [Total 9]
- 2 (a) underline or circle force B1
underline or circle velocity B1
- (b) (i) $4.07 - 4.1$ (s) B1
- (ii) $(v - u)/t$ OR $\Delta v/t$ OR in words OR use of $40 \div$ (ans. to (b)(i))
OR other correct values from graph C1
answer between 9.7 and 10 m/s² or m/s/s A1
- (iii) area under graph OR $\frac{1}{2}(u + v)t$ OR $\frac{1}{2} \times 40 \times$ (ans. to (b)(i)) C1
OR $s = ut + \frac{1}{2}at^2$ OR $v^2 = u^2 + 2as$ OR numbers substituted
82 m A1
- (c) graph continues in straight line to 6 s B1
- [Total 8]

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3 (a) (i) 1. (loss of P.E. =) mgh OR $92 \times 10 \times 1500$
 1.38×10^6 J
correct use of mgh with $h = 500$ or 2000 gains 1 mark only

(ii) 2. (K.E. =) $\frac{1}{2}mv^2$ OR $\frac{1}{2} \times 92 \times 52^2$
 1.244×10^5 J at least 2 sig. figs

(a) (ii) difference is due to:
(work done in overcoming) air resistance/drag
OR energy converted to/lost as heat (by air resistance/drag)

(b) (i) increases

(ii) 920 N

[Total 7]

4 (a) (i) mention of vacuum OR glass is a poor conductor
OR vacuum/gap between walls has no molecules/atoms/particles

B1

(ii) surface/silver (of walls) is good reflector/poor absorber (of radiation)
surface/silver (of walls) is poor emitter (of radiation)

B1

B1

(b) add a stopper/lid/bung/cover/top to reduce/prevent (loss of heat by) convection/conduction/radiation/evaporation OR to prevent steam/hot vapour leaving

M1

B1

made of insulator OR example of insulator to reduce/prevent (loss of heat by) convection/radiation/evaporation OR to prevent steam/hot air leaving

B1

[Total 6]

5 (a) (i) and (ii) marked together to maximum of 3 marks

(i) molecules escape/leave the liquid/form gas or vapour

B1

(ii) evaporation OR heat/(thermal) energy needed for evaporation leaves sweat cooler
fast(er) molecules/high(er) energy molecules escape

B1

OR slow(er) molecules left behind

heat flows from body to warm the sweat (so body cools)

B1

(b) (i) ($Q =$) $mc\Delta\theta$ OR mcT OR $60 \times 4000 \times 0.50$
 1.2×10^5 J / 120 kJ

C1

A1

(ii) $Q = mL$ in any form OR ($m =$) Q/L OR either with numbers
 $(m = 1.2 \times 10^5 / 2.4 \times 10^6 =) 0.05$ kg e.c.f from (b)(i)

C1

A1

[Total 7]

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- 6 (a) (i) (pressure =) force/area OR force per unit area OR ($P =$) F/A with symbols explained B1
- (ii) molecules collide with/hit walls/surface (of box) B1
molecule(s) exert force on wall B1
pressure is total force / force of all molecules divided by (total) area of wall B1
- (b) (i) ($P =$) $h\rho g$ OR in words OR $0.25 \times 13\ 600 \times 10$
 $34\ 000 \text{ Pa}$ OR N/m^2 C1
allow 1 mark for $h = 250$ used and $3.4 \times 10^7 \text{ Pa}$ obtained A1
- (ii) ($P = 1.02 \times 10^5 - 34\ 000$)
 $68\ 000 \text{ Pa}$ or N/m^2 B1
e.c.f. from (b)(i) only if (b)(i) is less than 1.02×10^5

[Total 7]

- 7 (a) two of:
ray through centre of lens undeviated
ray parallel to axis refracted to right hand focus
rays through left hand focus refracted parallel to axis B2
- rays extrapolated to a point B1
- accuracy marks: image 6 cm from lens B1
image 6 cm high B1
- (b) image is virtual/not real AND
cannot be seen on screen OR no rays come from (position of) image B1

[Total 6]

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8 (a) 15–25 Hz to 15 000–25 000 Hz / 15–25 kHz B1

(b) (i) (region) where air layers/molecules/particles are pushed together/moved together/closer (than normal)
OR (region) where (air) pressure raised/air (more) compressed/more dense

B1

(ii) (region) where air layers/molecules are pushed apart/far(ther) apart (than normal)
OR (region) where (air) pressure reduced/air expanded

B1

(c) (i) (sound is) loud(er) OR volume (of sound is) increased

B1

(ii) sound has a higher frequency/pitch OR higher note (heard)

B1

(d) 3.5 – 1.9 OR 1.6 (s) seen OR $v = 2d / 1.9$

C1

250×2 OR 500 (m) seen OR $v = (2d + 500)/3.5$

C1

(speed = 500 / 1.6 =) 312.5 m/s at least 2 sig. figs

A1

[Total 8]

9 (a) (i) all lamps off

(ii) 12Ω lamps (only) on

B1

(iii) 4Ω lamps (only) on

(b) (i) 12 V

B1

(ii) $I = V/R$ in any form OR V/R OR 12/12

C1

1.0 A OR 1 A

A1

e.c.f. from (b)(i)

(c) current in 4Ω lamp = 3 (A) (current in 12Ω lamp is in (b)(ii))

C1

$(P =) IV$ OR I^2R

C1

$(P =) 36$ W for 4Ω lamp; $P = 12$ W for 12Ω lamp

A1

e.c.f. from (b)(ii)

OR

$(P =) V^2/R$

(C1)

$(P =) 12^2/4 = 36$ W for 4Ω lamp OR $12^2/12 = 12$ W for 12Ω lamp

(C1)

$(P =) 12^2/4 = 36$ W for 4Ω lamp AND $12^2/12 = 12$ W for 12Ω lamp

(A1)

OR

$(P =) V^2/R$

(B1)

Same V for all lamps

(M1)

4Ω lamp has higher power / 12Ω has lower power

(A1)

[Total 7]

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- 10 (a) at least 3 concentric circles centred on wire
arrows clockwise on each circle / at least one circle
spacing of circles increasing as radius increases
- (b) (i) arrow pointing down on side AB, up on side CD
- (ii) forces on AB and CD are opposite OR up and down and separated / not in same line (so cause rotation)
OR have moments in same sense / direction
OR cause couple / torque
- (iii) to reverse current in loop or keep current in AB or CD in the same direction
OR keep current on side near a pole in the same direction when (plane of) coil is vertical
OR every half turn
OR when AB and CD swap sides
so that:
rotation continues (in same direction)
OR so that rotation doesn't reverse its direction
OR to maintain sense/direction of moments/couple
OR coil turns more than half a revolution

[Total 7]

- 11 (a) (i) 2 protons
2 neutrons
- (ii) a (fast moving) electron
- (b) electron/electrons removed from/gained by the molecule
- (c) (i) force because particle is charged
OR the force on the particles is perpendicular to their paths
OR direction of force changes as direction of motion changes
- (ii) α -particle curve up the page in at least half of width of field
 β -particle curve opposite to α -particle curve OR down page if α line has no curvature anywhere
smaller radius of β path clear

[Total 8]