



PHYSICS

0625/33

Paper 3 Core Theory

May/June 2016

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.

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

Cambridge will not enter into discussions about these mark schemes.

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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 that they 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.
<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".
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.

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- e.c.f. meaning “error carried forward” and is mainly applicable to numerical questions, but may occasionally 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 e.c.f. may be awarded, provided the subsequent working is correct, bearing in mind the earlier error.
- 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 only 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 one.
- Fractions** Only accept these where specified in the mark scheme.

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Question	Expected answer	Mark
1(a)	height (of water/liquid)	B1
1(b)(i)	3.10 (s) and 3.04 (s) and 3.16 (s)	B1
1(b)(ii)	correct sum (9.3) correct average (3.1)	C1 A1
1(c)	15.5×60 or 930 $930 \div 3.1$ 300 (drops)	C1 C1 A1
		Total: 7

Question	Expected answer	Mark
2(a)	(distance) = area under (speed-time) graph in words, numbers or symbols OR distance = speed \times time 4.4×10 44 (m)	C1 C1 A1
2(b)	C (cyclist is) accelerating (so) forward force must be greater than backward force OR there is a resultant (forward) force	B1 B1 B1
2(c)	$P = F \div A$ $120 \div 16$ 7.5 N/cm^2	C1 C1 A1 B1
		Total: 10

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Question	Expected answer	Mark
3(a)	force \times distance (from pivot) OR 300×2.4 720 (N m)	C1 A1
3(b)	sum of clockwise moment = sum of anticlockwise moment $720 = W \times 1.6$ OR $720 \div 1.6$ 450 (N)	C1 C1 A1
		Total: 5

Question	Expected answer	Mark
4(a)(i)	X: bulb Y: liquid (thread)	B1 B1
4(a)(ii)	arrow at 0 °C	B1
4(b)	ice melts any three from: molecules gain energy (from surroundings) molecules vibrate faster break bonds between molecules molecules move freely	B1 B3
		Total: 7

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Question	Expected answer	Mark
5(a)	any two from: lamps all have 6V or full voltage (across them) OR lamps are brighter if one (lamp) breaks, little/ no effect on other lamps can be switched on and off independently	B2
5(b)(i)	10 – 8.2 OR 1.8 (J)	B1
5(b)(ii)	diagram indicating smaller proportion of energy wasted (e.g. greater useful energy output OR smaller wasted energy output OR smaller energy input for same output)	B1
5(c)	any two advantages from: renewable (energy source) does not contribute to global warming does not contribute to atmospheric pollution conserves fossil fuel reserves any two disadvantages from: not a reliable supply of electricity large area of land needed (for a wind farm) unsightly threat to birds large number needed to replace one power station infrastructure more expensive (per MW) than fossil fuel power stations needs a suitable (windy) location	B2 B2
		Total: 8

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Question	Expected answer	Mark
6(a)	X-rays microwaves	B1 B1
6(b)	radio waves	B1
6(c)	any one from: cancer detection / treatment, sterilising (hospital equipment / dressings), gamma-ray photography / scanning, preserving food, detecting cracks in metal structures, locating leaks from underground pipes any one from: detecting forgeries, suntan beds, hardening dental fillings, astronomy, security pens, treating jaundice, locating blood / body fluids	B1 B1
		Total: 5

Question	Expected answer	Mark
7(a)	normal drawn at X <u>above and in the block</u>	B1
7(b)	ray refracted toward normal drawn from X to side RS	B1
7(c)	angle of incidence correctly labelled angle of refraction correctly labelled	B1 B1
7(d)	ray drawn refracted away from the normal	B1
		Total: 5

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Question	Expected answer	Mark
8(a)	(material Z) melts	B1
8(b)	<p>any five from:</p> <p>(plastic lid) is a good insulator</p> <p>(plastic lid) reduces (heat loss by) convection</p> <p>(plastic lid) reduces (heat loss by) evaporation</p> <p>(vacuum) reduces/prevents (heat loss by) convection</p> <p>(vacuum) reduces/prevents (heat loss by) conduction</p> <p>shiny/silver surface is a poor radiator/bad emitter (of thermal energy)</p> <p>at 60 °C material Z solidifies</p> <p>material Z maintains a constant temperature (60 °C) during solidification/ internal energy is given out</p>	B5
		Total: 6

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Question	Expected answer	Mark
9(a)	$V = I \times R$ OR $V \div R$ in words, numbers or symbols 2.0 ÷ 6.0 0.33 (A)	B1 B1 B1
9(b)(i)	arrows indicating field drawn from N to S	B1
9(b)(ii)	force upwards / reverses	B1
9(c)(i)	any two from: increase current in the coil increase the strength of the magnets or magnetic field increase the number of turns in the coil	B2
9(c)(ii)	force on (each side of) coil or turning effect is in opposite direction or coil turns in opposite direction (because) current (through motor) is in opposite direction	B1 B1
		Total: 9

Question	Expected answer	Mark
10(a)	$V_p \div V_s = N_p \div N_s$ in any form $230 / V_s = 4995 \div 555$ or $V_s = 230 \div 9$ $V_s = (555 \div 4995) \times 230$ 25.6 (V)	C1 C1 A1
10(b)	step-down (transformer)	B1
		Total: 4

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Question	Expected answer	Mark
11(a)(i)	(chemical symbol): X (nucleon number): A (proton number): Z any two for one mark	B2
11(a)(ii)	1. 95 2. 146	B1 B1
11(b)	same number of protons (in nucleus) different numbers of neutrons (in nucleus)	B1 B1
		Total: 6

Question	Expected answer	Mark
12(a)	(fast moving) electron negative (charge)	B1 B1
12(b)	line from count rate of 2000 8 (days)	C1 A1
12(c)(i)	$180 \div 4$ 45 (counts / min)	C1 A1
12(c)(ii)	any two from: radiation mutates DNA/damages (living) cells radioactive material still present (in soil/reactor core/after many years) negative public perception of nuclear power radioactive waste on site contains isotopes with long half-lives	B2
		Total: 8