
PHYSICS

5054/22

Paper 2 Theory

October/November 2018

MARK SCHEME

Maximum Mark: 75

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 **10** printed pages.

PUBLISHED**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.

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| Question | Answer | Marks |
|----------|--|-----------|
| 1(a) | it / speed does not have a direction / is a scalar quantity | B1 |
| 1(b)(i) | direction (of velocity) changes (as it moves around the Earth) | B1 |
| | its velocity <u>changes</u> with time (this is an acceleration) | B1 |
| 1(b)(ii) | arrow from satellite towards (centre of) Earth | B1 |
| 1(c) | no work done and force perpendicular to motion / no movement in direction of force | B1 |
| | (kinetic and gravitational potential) energy remains constant / no effect | B1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 2(a) | (place where entire) mass (seems) to be located | B1 |
| 2(b) | wide base / base area large | B1 |
| | low centre of mass | B1 |
| 2(c) | suspend lamina next to plumb line / mass on string | B1 |
| | mark vertical line on lamina / line along string / plumb line | B1 |
| | repeat from another point and centre of mass at intersection of lines | B1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 3(a) | all the water is heated or the water is mixed up or water heated uniformly or distributes heat (better) | B1 |
| | heated water rises or cold water sinks or convection transfers thermal energy (upwards) | B1 |

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| Question | Answer | Marks |
|----------|---|-----------|
| 3(b)(i) | molecules move / vibrate <u>faster</u> / <u>more</u> kinetic energy | B1 |
| | molecules push each other apart or molecules move apart or space between molecules increases or vibrate with greater amplitude | B1 |
| 3(b)(ii) | rises and liquids expand more (than solids) | B1 |

| Question | Answer | Marks |
|----------|---|-----------|
| 4(a)(i) | radiation or infrared (radiation / waves) or light | B1 |
| 4(a)(ii) | it / a black surface is a good absorber / poor reflector of radiation | B1 |
| | <u>more</u> energy / power output or <u>more</u> electricity produced | B1 |
| 4(b)(i) | $(P =) VI t$ or $24 \times 15 \times 3600$ or $24 \times 15 \times 60$ or 22 000 (J) | C1 |
| | 1.3×10^6 J | A1 |
| 4(b)(ii) | $(\Delta Q =) mc\Delta T$ or 29 (°C) or 45 – 16 (°C) | C1 |
| | $51 \times 4200 \times 29$ or $51 \times 4200 \times (45 - 16)$ | C1 |
| | 6.2×10^6 J | A1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 5(a) | charges / electrons are not free to move (in an insulator) | B1 |
| | any sensible example e.g. plastic / nylon / glass / rubber | B1 |
| 5(b)(i) | negative charge on left of K and positive charge on right of L | M1 |
| | equal numbers of charges and number ≤ 5 and no charges on right of K and no charges on left of L | A1 |

| Question | Answer | Marks |
|----------|---|-----------|
| 5(b)(ii) | 1 (negative) charge spreads throughout (surface of) sphere | B1 |
| | 2 (positive) charge on L disappears or L becomes neutral or equal number of positive and negative charges | B1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 6(a) | 32 counts / minute | B1 |
| 6(b)(i) | second (beta-particles) and third (gamma-rays) boxes ticked | B1 |
| 6(b)(ii) | 1 28 | B1 |
| | 2 32 | B1 |
| 6(c)(i) | (average) time (taken for) | M1 |
| | count rate / number of nuclei / number of atoms to halve | A1 |
| 6(c)(ii) | some readings are bigger than those before / readings fluctuate | B1 |
| | half-life / 5.3 years too long or 5 / 6 minutes too short | B1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 7(a) | magnetic (material) | B1 |
| | temporary / soft magnetic (material) | B1 |
| 7(b)(i) | it / a.c. changes direction or changes polarity / from positive to negative (continually) | B1 |
| | it / a.c. has varying size or is sinusoidal / like a sine wave | B1 |

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| Question | Answer | Marks |
|----------|--|-----------|
| 7(b)(ii) | magnetic field (in core / secondary coil) is not changing / remains constant | B1 |
| | no (electromagnetic) <u>induction</u> | B1 |

| Question | Answer | Marks |
|-----------|---|-----------|
| 8(a)(i) | 1 quantity of matter (in a body) | B1 |
| | 2 balance or scales | B1 |
| 8(a)(ii) | (k.e. =) $\frac{1}{2}mv^2$ | C1 |
| | $\frac{1}{2} \times 0.16 \times 8.7^2$ | C1 |
| | 6.1 J | A1 |
| 8(b)(i) | 1 deceleration or retardation | B1 |
| | 2 negative gradient or line slopes downwards (left to right) | B1 |
| 8(b)(ii) | 1 $0.88 \text{ s} \leq \text{time} \leq 0.90 \text{ s}$ | B1 |
| | 2 area or counting squares or $\frac{1}{2}bh$ in some form | C1 |
| | $3.7 \text{ s} \leq \text{distance} \leq 4.1 \text{ m}$ | A1 |
| 8(b)(iii) | ball hits ground or short time for deceleration or large force or ground is hard | B1 |
| 8(b)(iv) | internal / thermal energy (of ball and ground) has increased | B1 |
| | (internal energy) from kinetic energy | B1 |

| Question | Answer | Marks |
|----------|---|-----------|
| 8(c) | <p>any two from: smaller time to drop to zero velocity / hit ground</p> <p>line not straight or velocity does not change uniformly or gradient not constant smaller area under (first part of) graph or less distance travelled slower final velocity initial downward gradient steeper</p> | B2 |

| Question | Answer | Marks |
|----------|---|-----------|
| 9(a) | frequency of sound wave small(er) or its frequency is less than 20 000 Hz | B1 |
| 9(b)(i) | transmission of energy | B1 |
| | (through a medium) with no net movement of medium or by vibrating particles | B1 |
| | vibrations parallel (and antiparallel) to wave / energy travel direction or cannot be polarised | B1 |
| 9(b)(ii) | 1 two centres of rarefactions labelled <i>R</i> | B1 |
| | 2 distance from one point to adjacent identical point indicated (with double-headed arrow) | B1 |
| | 3. $(v =) f\lambda$ or $25\,000 \times 0.047 / 0.048 / 0.049$ or $25\,000 \times 4.7 / 4.8 / 4.9$ or $25\,000 \times 47 / 48 / 49$ | C1 |
| | 1200 m / s | A1 |
| 9(c)(i) | decreases | B1 |
| 9(c)(ii) | four / five straight lines in air that touch the compressions still in the liquid and no intermediate / extra lines between the correct lines | B1 |
| | at least four compressions in air parallel to each other | B1 |
| | at least four straight lines at shallower angle from horizontal and slope correct | B1 |

| Question | Answer | Marks |
|----------|--|-----------|
| 9(d) | object (to be cleaned) immersed in liquid / solvent | B1 |
| | object / liquid agitated / vibrated by ultrasound | B1 |
| | dirt (particles) shaken off or dislodges / removes dirt | B1 |

| Question | Answer | Marks |
|------------|---|-----------|
| 10(a) | electrons c.a.o. | M1 |
| | towards the ammeter or away from the negative terminal or towards the positive terminal | A1 |
| 10(b)(i) | thermistor c.a.o. | B1 |
| 10(b)(ii) | $1/R_T = 1/R_1 + 1/R_2$ or $1/R_T = 1/1.5 + 1/6.0$ or $(R_T =) R_1R_2/(R_1 + R_2)$ or $1.5 \times 6.0 / (1.5 + 6.0)$ | C1 |
| | 1.2 (Ω) | C1 |
| | 2.5 Ω | A1 |
| 10(b)(iii) | $(I =) V/R$ or $12/2.5$ | C1 |
| | 4.8 (A) | A1 |
| 10(b)(iv) | $I_A = I_R + I_Z$ | B1 |
| 10(c) | resistance of Z / thermistor decreases | B1 |
| | resistance of parallel combination decreases or total resistance (of circuit) decreases or current increases | B1 |
| | voltage (across 1.3 Ω) increases | B1 |
| | trace moves towards top of screen / upwards | B1 |

| Question | Answer | Marks |
|-----------------|---------------|--------------|
| 10(d)(i) | 8 | B1 |
| 10(d)(ii) | 1.5 V | B1 |