**Cambridge Assessment International Education**
Cambridge International General Certificate of Secondary Education

**PHYSICS** **0625/42**

Paper 4 Extended Theory **October/November 2017**

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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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

| Question | Answer | Marks |
|---|---|---|
| 1(a) | $\rho = m / V$ in any form OR ($m$ =) $\rho V$<br>OR *(m =)* $9000 \times 7.5 \times 10^{-5}$ | **C1** |
| | ($m$ =) 0.68 kg **accept** 680 g | **A1** |
| 1(b)(i) | $W = m g$ in any form or ($W$ = ) $m g$<br>OR ($W$ =) 0. $68 \times 10$ | **C1** |
| | ($W$ =) 6.8 N | **A1** |
| 1(b)(ii) | any **one** of:<br>weight has direction / mass does not<br>weight is a vector / mass is not<br>weight varies / mass does not<br>mass is amount of matter<br>weight is a force / mass is not | **B1** |
| 1(c)(i) | $\rho = h \rho g$ in any form OR ($\rho$ = ) $\rho / h g$<br>OR ($\rho$ =) $560 / (0.027 \times 10)$ | **C1** |
| | ($\rho$ =) $2.1 \times 10^3$ kg / $m^3$ | **A1** |
| 1(c)(ii) | explains why there is a resultant downward force | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | accelerate / increase speed OR decelerate / decrease speed OR stop | **B1** |
| | change direction / move in a curve o.w.t.t.e. | **B1** |
| 2(b) | change of shape OR size | **B1** |
| 2(c)(i) | $F = ma$ in any form OR ($a$ =) $F / m$<br>OR ($a$ =) 3500 / 1400 | **C1** |
| | ($a$ =) 2.5 m / $s^2$ | **A1** |
| 2(c)(ii) | $a = (v - u) / t$ in any form OR ($t$ =) $(v - u) / a$<br>OR ($t$ =) (30 – 0) / 2.5 OR 30 / 2.5 | **C1** |
| | ($t$ =) 12 s | **A1** |
| 2(c)(iii) | friction / air resistance / drag | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 3(a) | suitable fuel for a power station | **B1** |
| | any **three** from five:<br>• thermal energy / heat (from fuel)<br>• water / steam / gas heated OR steam produced<br>• (steam / gas) turns / moves / drives turbine<br>• (turbine) turns / moves / drives generator<br>• 2 correct energy transfers | **B3** |
| 3(b) | sun is energy source for plants / living matter (to grow) o.w.t.t.e. | **B1** |
| | plant / animal (remains compressed) into fuel OR carbon / chemical energy stored / trapped in plant / animal (remains) | **B1** |
| 3(c) | not renewable (as fuel is consumed) | **M1** |
| | could only be replaced over very long time period (e.g. clearly > 50 years) | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | any **one** of these six:<br>• evaporation: at surface OR no bubbles form) pair 1<br>• boiling: throughout liquid OR bubbles form )<br><br>• evaporation: at any temperature OR no heat needed) pair 2<br>• boiling: at specific temperature OR heat needed )<br><br>• evaporation: affected by draught / surface area) pair 3<br>• boiling: not affected by draught / surface area ) | **B1** |
| | any **one** pair of points | **B1** |
| 4(a)(ii) | (it / rate) increases AND {more molecules have enough energy to escape OR break bonds} | **B1** |
| 4(b)(i) | remains constant | **B1** |
| 4(b)(ii) | $E = m\,l$ in any form OR ($E$ =) $m\,l$ | **C1** |
| | $P$ = energy / $t$ in any form OR ($P$ =) energy / $t$ | **C1** |
| | ($P = 0.095 \times 2.3 \times 10^6 / (12 \times 60)$ =) 300 W | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 5(a) | any **three** of these five:<br>• any sensible mention of the sun (as source of energy)<br>• (thermal / heat / *IR* / electromagnetic) radiation<br>• white (or clearly implied) surfaces absorb less or don't absorb<br>• white (or clearly implied) surfaces reflect more<br>• to keep house cooler OR to reduce thermal energy / heat transferred to house | **B3** |
| 5(b) | decreases | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 6(a)(i) | diffraction | **B1** |
| 6(a)(ii) | 4 arcs between dashed lines centred vertically at centre of gap | **B1** |
| | any 3 wavelengths same as incident wavelengths including wavelength from wavefront in gap | **B1** |
| 6(b)(i) | wavefronts have smaller angular width<br>OR do not extend as far as dashed lines OR less (angular) spread | **B1** |
| 6(b)(ii) | increased wavelength OR more spreading | **B1** |
| | use of $v=f\lambda$ OR increased wavelength | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 7(a) | real (answers in any order for **7(a)**) | **B1** |
| | enlarged OR magnified | **B1** |
| | Inverted OR upside down | **B1** |
| 7(b)(i) | 1st straight incident ray from close to point object to mirror correctly reflected, $i = r$ | **M1** |
| | 2nd straight incident ray <u>from point object</u> to mirror correctly reflected, $i = r$ | **A1** |
| 7(b)(ii) | BOTH reflected rays extended back to intersect behind mirror | **M1** |
| | BOTH reflected rays extended back <u>in straight lines</u> AND I in correct position AND {labelled OR clearly indicated} | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 8(a) | $R_S = R_A + R_B$ in any form OR ($R_S$ =) $R_A + R_B$ OR ($R_S$ =) 4 + 8 | **C1** |
| | ($R_S$ =)12 (Ω) | **C1** |
| | ($R_P$ = )1 / (1 / $R_S$ + 1 / $R_C$) in any form<br>OR ($R_P$ =) $R_S R_C$ / ($R_S$ + $R_C$)<br>OR ($R_P$ =) 1 / (1 / 12 + 1 / 6) OR ($R_P$ =) (6 × 12) / 18 | **C1** |
| | ($R_P$ =) 4.0 Ω | **A1** |
| 8(b) | $V_8$ = supply $V$ × (8 / 12 ) OR = 24 × (8 / 12) | **C1** |
| | ($V_8$ =) 16 V | **A1** |
| | **OR** alternative route | |
| | $I_8$ = supply $V$ / 12 OR = 24 / 12 OR = 2 (A) | **(C1)** |
| | ($V_8$ = 2 × 8 =) 16 V | **(A1)** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="3">9(a)(i)</td><td>A (fixed)resistor<br>B thermistor<br>C L.E.D. OR light emitting diode</td><td></td></tr>
<tr><td>2 correct</td><td>B1</td></tr>
<tr><td>3 correct</td><td>B1</td></tr>
<tr><td>9(a)(ii)</td><td>any four from six:<br>• if cold / hot resistance of thermistor high / low<br>• if cold / hot voltage (across) thermistor high / low<br>• if cold / hot voltage of input to LED high / low<br>• if cold / hot there is current / no current in LED<br>• if cold LED lights / brighter<br>• if hot LED does not light / dimmer</td><td>B1</td></tr>
<tr><td rowspan="4">9(b)</td><td><table>
<tr><th>Row</th><th>A</th><th>B</th><th>C</th><th>(output of AND)</th><th>X</th></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>4</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>6</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>7</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>8</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td></td></tr>
<tr><td>row 1 of X correct – answer 0</td><td>B1</td></tr>
<tr><td>rows 2 AND 3 of X correct – both answers 0</td><td>B1</td></tr>
<tr><td>rows 4–8 of X correct – all answers 1</td><td>B1</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 10(a)(i) | clockwise arrows on at least 3 circles | **B1** |
| 10(a)(ii) | (magnetic) field becomes weaker / decreases (as distance from wire increases) | **B1** |
| 10(b)(i) | any **four** from these six:<br>• charge flows OR current in solenoid / wire / circuit<br>• solenoid becomes magnet / magnetised<br>• bolt becomes magnet / magnetised<br>• (such that) unlike poles (of solenoid and bolt are) facing o.w.t.t.e.<br>• bolt is attracted<br>• bolt moves / (door) locks / spring stretched | **B4** |
| 10(b)(ii) | solenoid OR bolt no longer magnetised OR bolt no longer attracted | **B1** |
| | (spring contracts and pulls) bolt back / bolt returns (to original position) / (door) unlocked | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 11(a) | nucleon numbers balance each side of equation | **B1** |
| | proton numbers balance each side of equation | **B1** |
| | $^{0}_{-1}\beta$ | **B1** |
| 11(b)(i) | background radiation OR radiation from the environment | **B1** |
| | rocks / ground / buildings / food / space / weapons testing / nuclear accidents or waste / sun / air / radon / argon | **B1** |
| 11(b)(ii) | random (variation) | **B1** |
| 11(b)(iii) | clear evidence of subtracting 23 from (original) count | **C1** |
| | clear evidence of dividing original / corrected count by 4 | **A1** |
| | clear evidence of adding 23 correctly to result after division | **A1** |