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**PHYSICAL SCIENCE**

**0652/41**

Paper 4 Extended Theory

**October/November 2018**

MARK SCHEME

Maximum Mark: 80

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**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 **9** 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.

| Question  | Answer   | Marks |
|-----------|--|-------|
| 1(a)      | the turning effect of the force ;<br>about a point ;                                   | 2     |
| 1(b)(i)   | vertical arrow at the spring pointing upwards ;  | 1     |
| 1(b)(ii)  | moment = force $\times$ distance / $3.6 \times 20$ ;<br>= 72 ;<br>N cm ;               | 3     |
| 1(b)(iii) | moment of force from spring = moment from $W/F \times 90 = 72$ ;<br>$F = 0.8(0)$ (N) ; | 2     |
| 1(b)(iv)  | ruler tilts down at spring end / spring is stretched;<br>moment (due to W) is larger ; | 2     |

| Question | Answer   | Marks |
|----------|--|-------|
| 2(a)     | <i>any three from:</i> <ul style="list-style-type: none"> <li>• lattice</li> <li>• positive ions / cations</li> <li>• sea of electrons</li> <li>• delocalised / free ;;;</li> </ul>  | 3     |
| 2(b)(i)  | $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ ;  | 2     |
| 2(b)(ii) | zinc;<br><br><i>any two from:</i> <ul style="list-style-type: none"> <li>• prevents oxygen / water / salt from attacking iron</li> <li>• named metal is more reactive or higher in the reactivity series</li> <li>• (idea of) sacrificial protection ;;</li> </ul> | 3     |

| Question  | Answer   | Marks |
|-----------|--|-------|
| 2(b)(iii) | too reactive / very reactive / violent reaction with water ;   | 1     |
| 2(c)      | B ;<br><br>any <b>one</b> from:<br><ul style="list-style-type: none"> <li>• iron is a transition metal / element</li> <li>• (typical property of transition metal compounds is) coloured compounds <b>or</b> act as a catalyst ;;</li> </ul>   | 2     |
| 2(d)      | oxide layer ;<br><br>prevents oxygen / water from getting in contact (with aluminium surface) ;  | 2     |
| 2(e)      | any <b>three</b> from:<br><ul style="list-style-type: none"> <li>• mixture of metals (with other elements)</li> <li>• different sized atoms</li> <li>• prevent atoms / layers sliding over each other</li> <li>• regular arrangement (of atoms) distorted / lattice distorted ;;;</li> </ul> | 3     |

| Question | Answer   | Marks |
|----------|--|-------|
| 3(a)     | to find the <u>fixed point</u> (s) ;   | 1     |
| 3(b)     | recognition that the fixed points are at 1.5 and 8.4 cm ;<br><br>100° : 6.9 cm leads to $100 \div 6.9 : 1 \text{ cm}$ or $100 \div 6.9$ or 14.49 or 14.5 (° / cm) ;<br><br>$2.8 \text{ cm} = 2.8 \times 100 / 6.9 = 41 \text{ (}^\circ\text{C)}$ ; | 3     |
| 3(c)(i)  | -10 to 250 or 260 (°C) ;   | 1     |
| 3(c)(ii) | <b>decrease</b> the bore diameter / <b>increase</b> the volume of the bulb;  | 1     |

| Question | Answer  | Marks    |
|----------|---|----------|
| 4(a)     | soluble / alkaline ;<br>neutral ;<br>heated ;<br>larger ;   | <b>4</b> |
| 4(b)     | proton or H <sup>+</sup> donor ;  | <b>1</b> |
| 4(c)     | <u>magnesium</u> carbonate is insoluble / making an insoluble salt from two soluble salts (ORA) / reaction is a precipitation reaction; | <b>1</b> |

| Question      | Answer   | Marks    |
|---------------|--|----------|
| 5(a)(i), (ii) | cross made or F marked where the refracted ray cuts the principal axis ;                                       | <b>3</b> |
|               | vertical arrow drawn between principal axis and point at which the rays cross each other ;<br>arrow inverted ; |          |
| 5(a)(iii)     | rays cross over ;  | <b>1</b> |
| 5(b)(i)       | (virtual image) the rays are traced back (by the eye) / rays diverge (after refraction) ;                      | <b>1</b> |
| 5(b)(ii)      | magnifying glass / to make things look bigger ;  | <b>1</b> |

| Question | Answer   | Marks |
|----------|--|-------|
| 6(a)     | <p><i>Mr of C<sub>2</sub>H<sub>6</sub></i><br/> <i>Mr of C<sub>2</sub>H<sub>6</sub> = 24 + 6 = 30 ;</i></p> <p><i>ratio</i><br/>           1 : 2 (or 2 : 4) ratio C<sub>2</sub>H<sub>6</sub> : 2CO<sub>2</sub> ;</p> <p><i>mass of CO<sub>2</sub></i><br/>           30 g C<sub>2</sub>H<sub>6</sub> = 2 × 24 dm<sup>3</sup> CO<sub>2</sub> <b>OR</b> 48 dm<sup>3</sup> CO<sub>2</sub><br/> <b>OR</b> 60 g C<sub>2</sub>H<sub>6</sub> = 4 × 24 dm<sup>3</sup> CO<sub>2</sub> ;</p> <p><i>volume of CO<sub>2</sub></i><br/>           (2000 ÷ 30 × 48) = 3200 ;</p> | 4     |
| 6(b)(i)  | <p><i>any two from:</i></p> <ul style="list-style-type: none"> <li>• carbon monoxide</li> <li>• carbon / soot</li> <li>• water ;;</li> </ul>   | 2     |
| 6(b)(ii) | <p><i>any one from:</i></p> <ul style="list-style-type: none"> <li>• soot on buildings</li> <li>• poisonous gas / binds irreversibly with the haemoglobin in blood / reduces capacity of blood to carry oxygen</li> <li>• climate change / global warming ;</li> </ul>   | max 1 |

| Question | Answer  | Marks |
|----------|---|-------|
| 7(a)     | <p><math>V = IR</math> <b>OR</b> <math>6.0 = I \times 5.0</math> <b>OR</b> <math>(I =) V \div R</math> <b>OR</b> <math>6 \div 5</math> ;</p> <p>1.2 (A) ;</p> | 2     |
| 7(b)     | <p>current through <b>R<sub>2</sub></b> = 3.0 – 1.2 <b>OR</b> 1.8 (A)</p> <p>resistance = 3.3 (<math>\Omega</math>) ;</p>                                     | 2     |

| Question | Answer   | Marks |
|----------|--|-------|
| 7(c)     | (power =) $VI$ <b>OR</b> $6 \times 3$ ;<br>18 (W); | 2     |

| Question | Answer   | Marks |
|----------|--|-------|
| 8(a)     | any <b>two</b> from: <ul style="list-style-type: none"> <li>• catalyst</li> <li>• increase rate of reaction / speed up reaction</li> <li>• provides alternate reaction pathway with lower activation energy ;</li> </ul> | 2     |
| 8(b)     | $\text{CH}_3\text{CH}_2\text{ONa}$ / $\text{NaCH}_3\text{CH}_2\text{O}$ ;  | 1     |
| 8(c)(i)  | addition ;   | 1     |
| 8(c)(ii) | alkene ;   | 1     |

| Question | Answer  | Marks |
|----------|---|-------|
| 9(a)(i)  | 1 (soft) iron (former or core) ;<br>2 primary / coil ;  | 2     |
| 9(a)(ii) | more turns in the primary or input coil (ORA) ;   | 1     |
| 9(b)     | any <b>three</b> from: <ul style="list-style-type: none"> <li>• current provides magnetic field</li> <li>• a.c. continuously changing (direction or size)</li> <li>• so magnetic field continuously changing</li> <li>• iron (core) easily magnetised or demagnetised / concentrates or directs the field through the secondary ;;;</li> </ul> <p>changing field needed to <u>induce</u> e.m.f (in the secondary) ;</p> | 4     |



| Question | Answer  | Marks |
|----------|---|-------|
| 9(c)     | to produce a low voltage power supply / sensible examples e.g. (phone or battery) charger / laboratory power supply / stepping down high voltages in a named device ; | 1     |

| Question | Answer   | Marks |
|----------|--|-------|
| 10(a)    | carbon dioxide + water = (glucose) + oxygen ;                | 2     |
| 10(b)    | sun(light) ;   | 1     |
| 11(a)    | random ;   | 1     |
| 11(b)    | background (radiation) ;                                     | 1     |
| 11(c)    | $\alpha$ -particles ;<br>low penetration / highly ionising ; | 2     |

| Question | Answer   | Marks |
|----------|--|-------|
| 12       | amphoteric ;<br>neutral ;<br>basic ;<br>acidic ; | 3     |