## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

**International General Certificate of Secondary Education** 

## MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

## 0652 PHYSICAL SCIENCE

0652/03

Paper 3 (Extended), 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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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| 1 | (a) (i)          | any value below 7 ;  | [1]         |
|---|------------------|--|-------------|
|   | (ii)             | pH rises; (ecf from <b>(i)</b> ) to above 7 / stated value above 7;  | [2]         |
|   | (iii)            | use the universal indicator/pH meter; (not litmus or just indicator)   | [1]         |
|   | (iv)             | $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ ;; (one mark for all formulae correct, one mark for balance if formulae correct)  | [2]         |
|   | bas              | ton source is (sulfuric) acid ;<br>se is proton acceptor ;   |             |
|   | H <sup>+</sup> / | <sup>′</sup> H ion & OH⁻/O ion form H₂O / water ;  | [3]         |
|   |                  |  | [Total: 9]  |
| 2 | (a) (i)          | wavelength marked correctly;   | [1]         |
|   | (ii)             | depth decreases; so speed reduces;   | [2]         |
|   |                  | $e$ of $v = f\lambda$ ;<br>7.5 Hz;   | [2]         |
|   | (c) (i)          | ray from lamp to boy's eye reflecting off water, $\mathbf{i} = \mathbf{r}$ ; traced back to the lamp;  | [2]         |
|   | (ii)             | ray drawn from lamp to boy's eye, $\mathbf{i} \neq \mathbf{r}$ ; second ray drawn from lamp to boy's eye, $\mathbf{i} \neq \mathbf{r}$ ; explanation such as diffuse reflection*; (*an outstanding explanation which shows real understanding, could score |             |
|   |                  | 2 marks if only 1 mark is scored in the diagram)   | [3]         |
|   |                  |  | [Total: 10] |

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3 (a) (i) sugar/named carbohydrate source e.g. grapes/starch/bread;

mixed with yeast;

kept warm / at 35 °C at correct temperature;

[3]

(ii)  $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ ;;

(one mark for all formulae correct, one mark for balance if formulae correct)

[2]

**(b)**  $C_2H_5OH = 46$ ;

0.8/46;

= 417 (accept 420/417.3/417.4);

[4]

(c) any three from:

long chain hydrocarbons / alkanes broken down;

to form short chain hydrocarbons / alkanes and alkenes;

using heat;

and a catalyst;

(if distillation is discussed zero marks are scored)

[max 3]

[Total: 12]

4 (a) (i) charge moves from A to B/or electrons move from B to A/A discharges through B;

current is a movement of charge / current to Earth through ammeter; (reject current in the first part)

[2]

(ii) electrical (potential) energy;

goes to thermal/heat energy/light energy;

and sound energy;

(any mention of kinetic energy **only** the first mark can be scored)

[3]

[2]

[2]

**(b) (i)** use of  $V = IR = (0.0012 \times 10^{-3} \times 50\ 000)$ ; 60 mV, 0.060 V;

00111V, 0.000 V,

(ii) <u>use</u> of q = It (= 0.0012 × 10<sup>-3</sup> × 1.5 × 10<sup>-3</sup>; 1.8 × 10<sup>-9</sup> C;

(iii) <u>use</u> of E = VQ or VIt (= 0.0012 × 10<sup>-3</sup> × 1.5 × 10<sup>-3</sup> × 0.06); 1.08 × 10<sup>-10</sup> J; [2]

[Total: 11]

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| 5 | (a)    | group number is the same as the number of electrons in the outer shell;  |                      |  | [1]                      |             |
|   | (b)    | cha  | nges                 | from metallic to non-metallic / metallic to covalent;  |                          | [1]         |
|   | (c)    | (i)  | Li <sub>2</sub> O    | ;  |                          | [1]         |
|   |        | (ii)   | from<br>from<br>(acc | tron(s) transferred; (outer shell of) lithium atom to (outer shell) of oxygentwo lithium atoms transfer one electron each to one ept a clearly labelled diagram) (rence to covalent bonding no marks)      |                          | [3]         |
|   | (d)    | diagram showing two nitrogen atoms with at least one shared pair of electrons; three shared pairs of electrons in total, with no other electrons in outer shell; inner shell with two electrons; |                      |  |                          | [3]         |
|   |        |  |                      |  |                          | [Total: 9]  |
| 6 | (a)    |  |                      | ngs/forceps/protective clothing/gloves/lead shieldi<br>kposure time/goggles/storing in lead)   | ing / not point source ; | [max 1]     |
|   | (b)    | <b>b)</b> background radiation or very clear source ;  |                      |  |                          | [1]         |
|   | (c)    | (i)  | rand                 | om variation of emissions ;  |                          | [1]         |
|   |        | (ii)   | alphabeta gam (the   | a ✓ beta × gamma ✓ ; a – significant change with thin card ; – no significant change with aluminium ; ma – significant penetration through lead / reading a answer must refer to the experiment not genera | al properties and the    |             |
|   |        |  | corre                | anation cannot be given the mark unless the pect)  | oresence/absence is      | [4]         |
|   | (d)    | (i)  |                      | highly ionising; chance of collision with cancerous cells;   |                          | [2]         |
|   |        | (ii)   |                      | a very short range ;<br>ld not reach tumour / would damage healthy cells or  | n the way ;              | [2]         |
|   |        |  |                      |  |                          | [Total: 11] |

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7 (a) (i) carbon / coke is burned to make carbon dioxide;

carbon dioxide is reduced by more carbon / coke to carbon monoxide;

(one mark only for carbon / coke reacts with oxygen to form carbon monoxide)

(ii)  $C + O_2 \rightarrow CO_2$ ;  $CO_2 + CO \rightarrow 2CO$ ;

(one mark only for 2C +  $O_2 \rightarrow 2CO$ )

[2]

[2]

(b) 112 (tonnes iron produced) or 160 tonnes iron(III) oxide;

160/112 or 60 000/112;

= 85 714 tonnes;

(treat use of wrong formula as an arithmetic error so first mark only is lost)

[1]

[1]

- (c) (i) by using additives / by adding other metals / by adding other elements ;
  - (ii) to change / improve properties / to make harder / to prevent rusting / stronger; [1]
- (d) aluminium is more reactive than carbon / carbon will not reduce aluminium oxide; [1]

[Total: 10]

- 8 (a) (i) balance (accept scale(s)/measuring scales);measuring cylinder (reject beaker);[2]
  - (ii) volume of water in cylinder  $(v_1)$  AND volume of water plus stone  $(v_2)$ ; mass of stone (m); [2]
  - (iii)  $v_2 v_1$ ; divide mass by volume; [2]
  - (b) <u>use of density = mass/volume = 1.12 = 280/v;</u>  $250 \text{ (cm}^3)$ ; [2]

[Total: 8]