

**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.

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- 1 (a) (i) any value below 7 ; [1]
- (ii) pH rises ; (ecf from (i))  
to above 7 / stated value above 7 ; [2]
- (iii) use the universal indicator / pH meter ; (not litmus or just indicator) [1]
- (iv)  $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$  ;  
(one mark for all formulae correct, one mark for balance if formulae correct) [2]

- (b) proton source is (sulfuric) acid ;  
base is proton acceptor ;  
 $\text{H}^+$  / H ion &  $\text{OH}^-$  / O ion form  $\text{H}_2\text{O}$  / water ; [3]

**[Total: 9]**

- 2 (a) (i) wavelength marked correctly ; [1]
- (ii) depth decreases ;  
so speed reduces ; [2]

- (b) use of  $v = f\lambda$  ;  
 $F = 7.5 \text{ Hz}$  ; [2]

- (c) (i) ray from lamp to boy's eye reflecting off water,  $i = r$  ;  
traced back to the lamp ; [2]
- (ii) ray drawn from lamp to boy's eye,  $i \neq r$  ;  
second ray drawn from lamp to boy's eye,  $i \neq r$  ;  
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]**

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
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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]
- (b) (i) use of  $V = IR = (0.0012 \times 10^{-3} \times 50\,000)$  ;  
60 mV, 0.060 V ; [2]
- (ii) use of  $q = It (= 0.0012 \times 10^{-3} \times 1.5 \times 10^{-3})$  ;  
 $1.8 \times 10^{-9} \text{ C}$  ; [2]
- (iii) use of  $E = VQ$  or  $VIt (= 0.0012 \times 10^{-3} \times 1.5 \times 10^{-3} \times 0.06)$  ;  
 $1.08 \times 10^{-10} \text{ J}$  ; [2]

[Total: 11]

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
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- 5 (a) group number is the same as the number of electrons in the outer shell ; [1]
- (b) changes from metallic to non-metallic / metallic to covalent ; [1]
- (c) (i)  $\text{Li}_2\text{O}$  ; [1]
- (ii) electron(s) transferred ;  
 from (outer shell of) lithium atom to (outer shell) of oxygen atom ;  
 from two lithium atoms transfer one electron each to one oxygen atom ;  
 (accept a clearly labelled diagram)  
 (reference 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) use of tongs / forceps / protective clothing / gloves / lead shielding / not point source ;  
 (reject exposure time / goggles / storing in lead) [max 1]
- (b) background radiation or very clear source ; [1]
- (c) (i) random variation of emissions ; [1]
- (ii) alpha ✓ beta ✗ gamma ✓ ;  
 alpha – significant change with thin card ;  
 beta – no significant change with aluminium ;  
 gamma – significant penetration through lead / reading above background ;  
 (the answer must refer to the experiment not general properties and the  
 explanation cannot be given the mark unless the presence/absence is  
 correct) [4]
- (d) (i) very highly ionising ;  
 high chance of collision with cancerous cells ; [2]
- (ii) alpha very short range ;  
 would not reach tumour / would damage healthy cells on the way ; [2]

**[Total: 11]**

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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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) [2]
- (ii)  $C + O_2 \rightarrow CO_2$  ;  
 $CO_2 + CO \rightarrow 2CO$  ;  
(one mark only for  $2C + O_2 \rightarrow 2CO$ ) [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]
- (c) (i) by using additives / by adding other metals / by adding other elements ; [1]
- (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) use of density = mass / volume = 1.12 = 280 /  $v$  ;  
250 ( $cm^3$ ) ; [2]
- [Total: 8]**