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

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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) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$;;
(one mark for all formulae correct, one mark for balance if formulae correct) [2]

(b) proton source is (sulfuric) acid ;
base is proton acceptor ;
H^+ / H ion & OH^- / O ion form H_2O / 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 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** ≠ **r** ;
second ray drawn from lamp to boy's eye, **i** ≠ **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]

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 $q = It$ $(= 0.0012 \times 10^{-3} \times 1.5 \times 10^{-3}$;
1.8×10^{-9} C ; [2]

(iii) use of $E = VQ$ *or* VIt $(= 0.0012 \times 10^{-3} \times 1.5 \times 10^{-3} \times 0.06)$;
1.08×10^{-10} J ; [2]

[Total: 11]

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)** Li_2O ; [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)** <u>random</u> 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]

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]