UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

0653 COMBINED SCIENCE

0653/32 Paper 3 (Extended Theory), 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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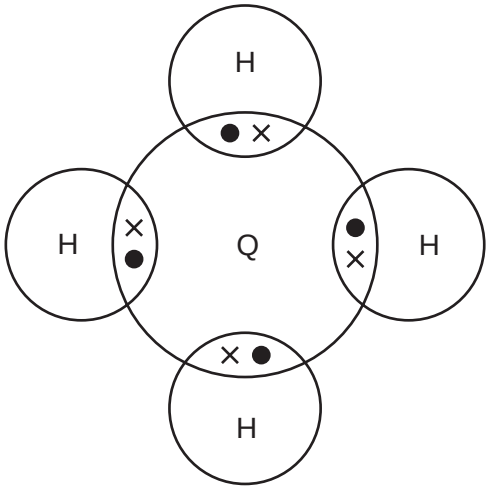
UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) (i) argentite and galena (or formulae) ; [1]

(ii) scheelite (or formula) ; [1]

(b) (i) silicon ;
four outer electrons so in Group IV ;
three shells so in third period ;
OR
silicon ;
electron configuration is 2,8,4 / inner shells must be full / silicon has 14 electrons ;
so proton / atomic number is 14 ; [max 3]

(ii)



(does not have to be dots and crosses)
at least one shared pair of electrons ;
four shared pairs ;
(max 1 if extraneous electrons) [2]

(iii) $QO_2 + 2C \rightarrow Q + 2CO$;; [2]
(formulae and balanced marked separately)

[Total: 9]

2 **(a)** units of m / s and s ;
axes right way round and suitable scale labelled speed and time ;
accurate line drawn on graph ; [3]

(b) **(i)** average speed = distance / time ;
= 200 / 25 = 8 m / s ; [2]

(ii) KE = ½ mv^2 ;
= ½ × 70 × 6 × 6 = 1260 J ; [2]

(c) **(i)** heat transferred from body to sweat / heat absorbed by sweat from athlete's body ;
kinetic energy of water molecules increases / some molecules move faster than others ;
faster moving / more energetic (water) molecules escape / leave the surface / break bonds / break forces of attraction ;
(KE) / energy of (remaining) water molecules (in sweat) decreases ; [3]

(ii) any two from:
increased temperature / reduced humidity / increased windspeed / increased surface area ; [max 1]

[Total: 11]

3 **(a)** (chemical reactions that) break down / glucose (molecules) ;
to release energy ; [2]

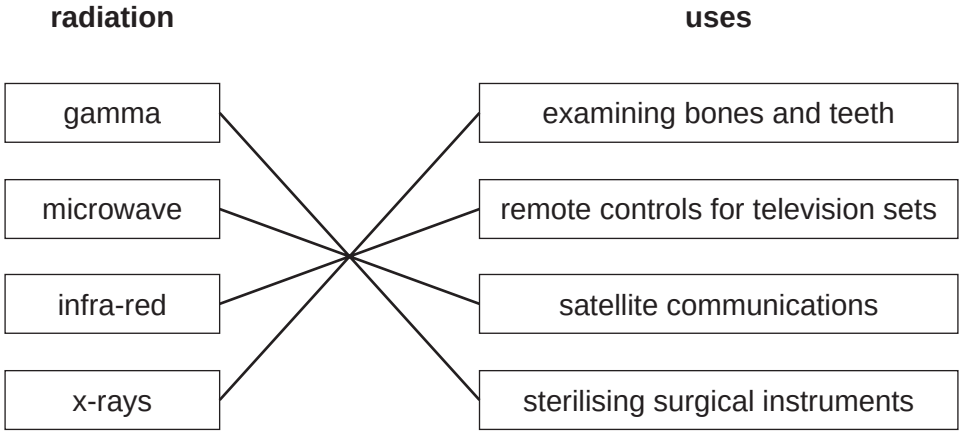
(b) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$;; [2]
(formulae and balanced)

(c) in red blood cells ;
attached to / combined with, haemoglobin ; [2]

[Total: 6]

4 **(a)** radio waves are transverse and sound waves are longitudinal ;
radio waves have a higher frequency (than sound waves) ;
radio waves move at a faster speed (than sound waves) ;
sound waves need a medium, radio waves do not ;
radio waves can travel further (than sound waves) ;
radio waves have a larger range of frequencies (than sound waves) ; [max 2]

(b)



(all correct gains 2 marks, 3 or 2 correct gains 1 mark) [2]

(c) $v = f \times \lambda$ / speed = frequency × wavelength
$= 6 \times 10^{-7} \times 5 \times 10^{14} = 3 \times 10^{8}$ m / s ; [2]

(d) measure mass using a balance ;
measure volume using displacement can or increase in volume of water in a measuring cylinder ;
density = mass / volume ; [3]

[Total: 9]

5 **(a)** use of chlorine / ozone / ultrafiltration / boiling / distillation ; [1]

(b) in water (molecules) hydrogen (atoms) are bonded to oxygen (atoms) ;
in the mixture they are not ;

in water the H:O ratio is 2:1 ;
in the mixture no fixed ratio ;

water unreactive / puts out flame ;
mixture burns / will react ;

a mixture can be separated by physical means ;
a compound cannot / can only be separated by chemical means ;

a compound contains different elements that are chemically bonded ;
a mixture means two different substances which are not combined ;

the compound water is formed by chemical reaction ;
the mixture of elements hydrogen and oxygen is not formed by chemical reaction ;

(any **one** pair for 2 marks) [max 2]

(c) **(i)** silicon dioxide ; [1]

(ii) sodium chloride forms a solution / is soluble (so all passes through the filter) ;
hexane is (also) a liquid (at room temperature) (and so also passes through filter) ; [2]

(d) **(i)** add carbonate to acid ;
keep adding carbonate until no more dissolves / reacts ;
filter (and keep filtrate) ; [3]

(ii) zinc carbonate + sulfuric acid → zinc sulfate + carbon dioxide + water [2]

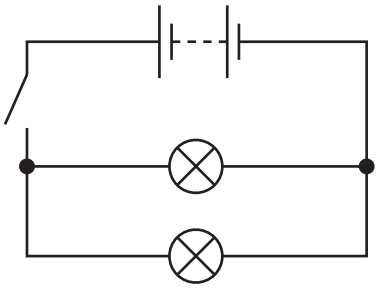
left-hand side correct 1 mark ; right-hand side correct 1 mark ;

[Total: 11]

6 **(a)** air molecules will move faster ; [1]

(b) change shape ;
change speed / start object moving / stop object moving / acceleration etc ;
change direction of motion of object ;
(3 correct gains 2 marks, 1 or 2 correct gains 1 mark) [max 2]

(c)



symbols all correct ;
complete / full circuit ;
lamps in parallel ;
(and if lamps in parallel) then switch operates both lamps ; [4]

[Total: 7]

7 **(a)** trees reduce the temperature ;
reference to figures from the graph / quantitative comparison ; [2]

(b) **(i)** edge of forest ; [1]

(ii) open sand is hotter so produced more females / in forest cooler so produced more males ;
reference to above 29 °C for producing females / below 29 °C for producing males ; [2]

(c) deforestation will result in hotter / open / more open sand / result in a higher temperature ;
so more female turtles produced / fewer males ;
which might make breeding difficult / might reduce number of young born or increase the number of eggs laid ; [max 2]

(d) more carbon dioxide in the atmosphere ;
reference to global warming / effects of global warming ;

less oxygen in the atmosphere ;
reference to possible harmful effects relating to respiration ;

fewer roots to hold soil in place / fewer leaves to protect from rain ;
more erosion ;

fewer trees to absorb rain water ;
more flooding ;
(any **two** pairs for max 2 marks each pair) [max 4]

[Total: 11]

8 **(a)** (expt. **2**)
potassium hydroxide is an alkali / contains hydroxide ions ; [1]

(b) (expt. **1**)
temperature decreased ; [1]

(c) orange solid formed / solution becomes paler blue / colourless ; [1]
(allow effervescence)

(d) magnesium more reactive than copper ; [1]

(e) no reaction occurred ;
so there was no change in temperature / no energy was transferred ;
copper is less reactive than magnesium ; [max 2]

[Total: 6]

9 (a) (i) greatest activity at pH 6.5 / between 6 and 7 ;
no activity at / below pH 4 and at / above pH 9 ; [2]

(ii) pH changes the shape of the enzyme (molecule) ;
changes shape of active site ;
so substrate can no longer fit into it ; [max 2]

(iii) curve of similar shape with peak at pH 4 or below ; [1]

(iv) sodium hydrogencarbonate neutralises the acid ;
so pH rises (above optimum for enzyme) ; [2]

(b) break down / digest, large molecules ;
to small molecules ;
(small) molecules can be absorbed / can be taken into the blood / can pass through the wall of the gut / can diffuse into cells ; [3]

[Total: 10]