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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

0654 CO-ORDINATED SCIENCES

0654/33 Paper 3 (Extended Theory), maximum raw mark 120

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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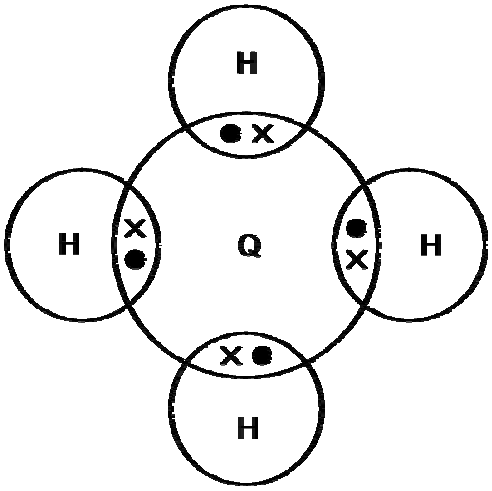
1 **(a)** **(i)** argentite and galena (or formula or chemical name) ; [1]

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

(b) **(i)** germanium ;
four outer electrons so in Group IV ;
four shells so in fourth period ; [3]

(ii)



(does not have to be dots and crosses)

at least one shared pair of electrons ;
four shared pairs giving QH_4 ;
no extraneous electrons ; [3]

(iii) $QO_2 + 2H_2 \rightarrow Q + 2H_2O$;; [2]
(balanced marked dependent on correct formulae)

[Total: 10]

2 **(a)** coil / wire is moving in magnetic field / changing magnetic field / cuts lines of magnetic force ;
e.m.f/voltage/current is, induced / produced (to light lamp) ;
brushes / slip rings, form electrical connection ;
stop connecting wires getting twisted ; [4]

(b) heat absorbed from athlete's body / heat transferred from body to sweat
some molecules move faster than others / (kinetic) energy of the water molecules increases ;
more energetic / faster molecules escape / leave the surface / break bonds / forces of attraction ;
(average) energy (remaining) particles goes down ; [max 2]

[Total: 6]

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3 **(a)** **(i)** greatest activity / optimum pH 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 / reacts with the acid ;
so pH rises (above optimum for enzyme) ; [2]

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

(c) **(i)** **A** capillary ;
B lacteal ; [2]

(ii) increase surface area ;
in the small intestine / duodenum / ileum ;
for absorption ;
amino acids / glucose, absorbed into capillaries ;
fats / fatty acids / glycerol, absorbed into lacteal ; [max 3]

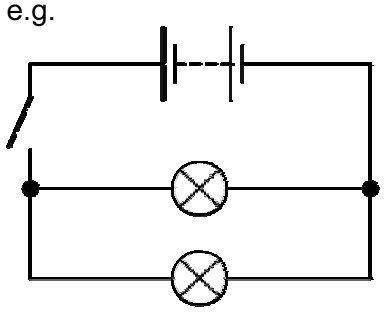
[Total: 15]

4 **(a)** **(i)** molecules collide with tyre wall ;
force exerted causing pressure ; [2]

(ii) they move faster / have more kinetic energy ; [1]

(iii) particles collide with wall more often ;
collisions, are harder / faster / have more energy ; [2]

(b) symbols correct and all complete in complete circuit ;
lamps in parallel and switch operates both lamps ;
e.g.



[2]

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(c) KE = ½ mv^2 **OR** (m) = 2 × KE / v^2 ;
m = (2 × 1 120 000) / (40 × 40) = 1400 kg ; [2]

(d) mass increases so KE / momentum increases ;
greater force needed (to reduce momentum) / longer braking time / distance needed (to reduce KE) ;
(accept reverse arguments) [2]

(e) force = mass × acceleration ;
acceleration = 1500 / 1200 = 1.25 m / s^2 ; [2]

[Total: 13]

5 **(a)** **(i)** unsaturated molecule contains double / multiple bond **OR** saturated has only single bonds ; [1]

(ii) add bromine (solution) ;
if unsaturated colour changes from orange to colourless ; [2]
(allow potassium manganate(VII) purple to colourless)

(b) **(i)** as molecular size / number of C atoms / chain length / mass increases boiling point increases ;
alkenes have lower boiling points than similar sized alkanes ; [2]

(ii) (as molecular size / surface area increases) intermolecular / (attractive) forces between molecules increase ;
so more (heat) energy needed to separate molecules / break forces/bonds ; [2]
(*accept reverse argument*)

[Total: 7]

6 **(a)** female is **XX** and male is **XY** ;
each egg contains an **X** chromosome and each sperm contains either **X** or **Y** ; [2]

(b) trees reduce the temperature / more trees lower temperature ;
reference to figures from the graph / quantitative comparison ; [2]

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

(ii) open sand is hotter so produced more females / **OR** in forest lower so produced more males ;
reference to above or below 29 °C ;
low vegetation is very close to 29 °C and so produced approximately equal males and females ; [max 2]

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

(e) more carbon dioxide in the atmosphere / less absorption of carbon dioxide ;
reference to global warming / effects of global warming / climate change / increase reaction between CO_2 and seawater making it more acidic ;

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

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

fewer trees to absorb rain water ;
more flooding ;

(any **two** pairs) [max 4]

[Total: 13]

7 **(a)** **(i)** working ;
55 (± 2) s ; [2]

(ii) contains two fewer protons and two fewer neutrons ;
changed to, polonium / atom with 84 protons (in nucleus) ; [2]

(iii) alpha particles contain 2 protons but no electrons ;
therefore positively charged ; [2]

(b) **(i)** beta radiation passes through paper / thin aluminium but is stopped by thick aluminium or (thin) lead ;
gamma radiation able to pass through aluminium and thin lead / only stopped by thick lead / concrete; [2]

(ii) the electrons are knocked out of / removed / lost from the atom ; [1]

(c) distance between two waves ;
distance between identical points on two successive waves ; [2]
(*or shown on diagram*)

[Total: 11]

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8 **(a)** in water (molecules) hydrogen (atoms) are bonded to oxygen (atoms) ;
in the mixture only like atoms are bonded ;

in water the H:O ratio is 2:1 / formula is H_2O ;
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 can only be separated by chemical means ;

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

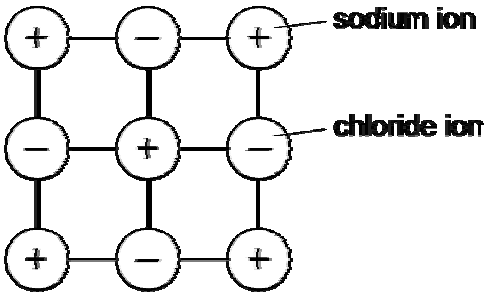
the compound water is formed by chemical reaction ;
the mixture of the elements hydrogen and oxygen is not formed by chemical reaction ; [max 2]

(any **one** pair for 2 marks but needs statement about compound and mixture)

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

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

(iii)



ions / charged particles shown alternating ;
sodium and chloride correctly labelled ;
reasonable square shape ; [3]

(c) mix carbonate with acid ;
keep adding carbonate until no more dissolves / reacts ;
filter (and keep filtrate) ;
(warm the filtrate) to evaporate (some) (water) ; [4]

[Total: 12]

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9 **(a)** label line to palisade cell ; [1]

(b) allow carbon dioxide to enter (the leaf) ;
allow oxygen to leave ;
by diffusion ; [max 2]

(c) **(i)** label line to any cell within mesophyll layers (**not** vein or air space) ; [1]

(ii) magnesium needed to make / for chlorophyll / is in chlorophyll ;
chlorophyll is green / labelled part contains chloroplasts ; [2]

[Total: 6]

10 **(a)** transverse / longitudinal ;
radio higher frequency ;
radio has higher range of frequency ;
different speed ;
radio travels further ;
radio can travel in a vacuum / sound cannot / needs a medium ;
(2 marks for all three, 1 mark for one or two correct) [max 2]

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

(c) *rectangular block*
refraction towards normal on entry ;
and refraction away from normal on leaving ;
triangular block
correct refraction and / or dispersion on entry ;
correct refraction and / or dispersion on leaving ; [4]

(d) speed = distance / time ;
= 500 / 1.5 = 333 m / s ; [2]

[Total: 10]

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

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

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

(b) in expt. **5** the temperature increased more quickly (than expt. **6**) ;
because the rate of reaction was greater / collisions more frequent ;
so energy was transferred more quickly ;
because powder has greater surface area ; [max 3]

(c) reference to electron loss as oxidation / gain as reduction ; [1]

(d) (i) $3.25 \div 65 = 0.05$; [1]

(ii) (copper is in excess)
idea of 1:1 reacting ratio of Zn:Cu ;
and greater number of moles of copper than zinc ; [2]

[Total: 11]

12 (a) (chemical reactions that) break down glucose (molecules) / glucose reacts with oxygen ;
to release energy ; [2]

(b) (i) glucose $\rightarrow$ alcohol / ethanol + carbon dioxide ; [1]

(ii) makes dough / bread rise ;
yeast uses sugars (from flour) ;
yeast produces carbon dioxide ;
(carbon dioxide) trapped in the dough ; [max 3]

[Total: 6]

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