UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0352851970

COMBINED SCIENCE **0653/32**

Paper 3 (Extended) **May/June 2012**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **19** printed pages and **1** blank page.

For Examiner's Use

1 **(a)** Most atoms of metallic elements found in the Earth's crust exist in compounds called ores which are contained in rocks.

The chemical formulae of some metal compounds found in ores together with the names of the ores are shown below.

argentite	Ag_2S
chromite	$FeCr_2O_4$
galena	PbS
scheelite	$CaWO_4$

(i) A binary compound is one that contains only two different elements.

State which of the compounds in the list above are binary compounds.

..... [1]

(ii) State the ore from which the metallic element tungsten could be extracted.

..... [1]

(b) Fig. 1.1 shows an incomplete diagram of an atom of an element **Q** in which only the outer shell electrons are shown.

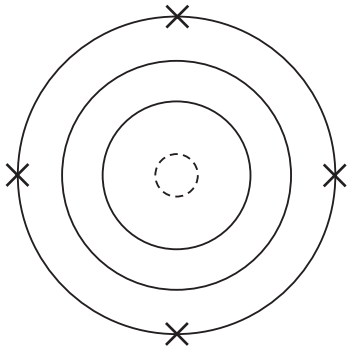


Fig. 1.1

(i) Name element **Q** and explain your answer.

name .....

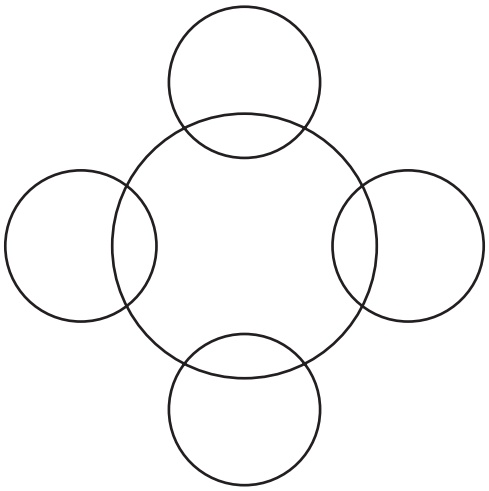
explanation .....

.....

..... [3]

(ii) Element **Q** combines with hydrogen to form covalent molecules which have the formula QH_4.

Complete the bonding diagram below to show how the bonding electrons are arranged.



[2]

(iii) Element **Q** may be extracted from its oxide, QO_2, in a reaction with carbon, C.

In this reaction, the compound carbon monoxide, CO, is formed in addition to the free element **Q**.

Suggest a balanced symbol equation for this reaction.

..... [2]

[Turn over

For Examiner's Use

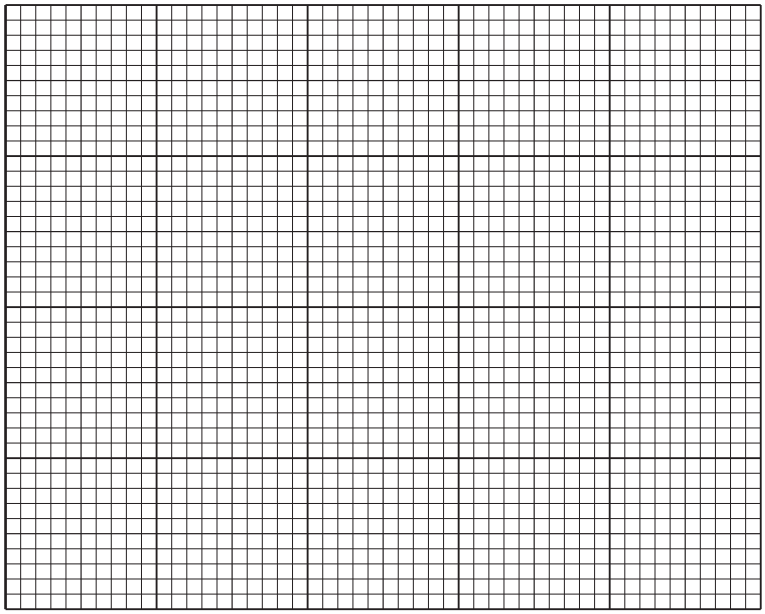
2 An athlete warms up by running along a race track.

(a) He accelerates from rest and after 10 seconds reaches a maximum speed of 7 m / s.

He continues at this speed for another 10 seconds.

During the next 5 seconds, he steadily slows down and stops.

Draw a speed-time graph to show the motion of the athlete.



[3]

(b) He then competes in a 200 m running race.

(i) He completes the race in 25 seconds.

Calculate his average speed.

State the formula that you use and show your working.

formula used

working

..... [2]

For Examiner's Use

(ii) The mass of the athlete is 70 kg.

Calculate the kinetic energy of the athlete when he is travelling at 6 m / s.

State the formula that you use and show your working.

formula used

working

..... [2]

(c) During a race the athlete cools down by sweating.

(i) Describe and explain, in terms of the movement of water molecules, how evaporation cools down the athlete.

.....

.....

.....

.....

..... [3]

(ii) State **two** factors which would increase the rate of evaporation.

..... and ..... [1]

3 **(a)** Define the term *respiration*.

.....

.....

..... [2]

(b) State the balanced symbolic equation for aerobic respiration.

..... [2]

(c) Outline how oxygen is transported to a respiring cell in a muscle.

.....

.....

..... [2]

For Examiner's Use

For Examiner's Use

4 **(a)** Radio waves are electromagnetic waves. Sound waves are not.

State **two** other ways in which radio waves differ from sound waves.

1 .....

.....

2 .....

.....

[2]

(b) Draw lines to connect each type of radiation to its use.

radiation	**use**
gamma	examining bones and teeth
microwave	remote controls for television sets
infra-red	satellite communications
X-rays	sterilising surgical instruments

[2]

(c) Visible light is another type of electromagnetic wave.

The frequency of green light is 5×10^{14} Hz.
The wavelength of green light is 6×10^{-7} m.

Calculate the speed of green light.

State the formula that you use and show your working.

formula used

working

..... [2]

(d) Describe how to find the density of a small irregular object such as a tooth.

For Examiner's Use

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.....

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.....

.....

..... [3]

5 Water supplies are often impure and have to be purified to make them safe for humans to drink.

(a) State **one** way that harmful bacteria may be removed from water during purification.

.....[1]

(b) Water is a compound which contains the elements hydrogen and oxygen.

Describe **one** difference, other than physical state, between the **compound** water and a **mixture** of the elements hydrogen and oxygen.

.....

.....

.....[2]

(c) Table 5.1 shows information about water and three compounds that can form mixtures with water.

Table 5.1

compound	melting point / °C	boiling point / °C	solubility in water
water	0	100	–
sodium chloride	801	1413	soluble
silicon dioxide	1650	2230	insoluble
hexane	–95	69	insoluble

(i) State which compound in Table 5.1 could be separated from a mixture with water by filtration.

.....[1]

(ii) Explain why the other two compounds **cannot** be separated from a mixture with water by filtration.

.....

.....

.....

.....[2]

(d) (i) A student was asked to use the reaction between the insoluble compound zinc carbonate and dilute sulfuric acid to make a solution that contained only the salt zinc sulfate.

Describe the main steps of a method the student should use to carry out this task.

You may draw labelled diagrams if it helps you to answer this question.

.....

.....

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.....

..... [3]

(ii) Suggest the word chemical equation for the reaction between zinc carbonate and dilute sulfuric acid.

..... [2]

For Examiner's Use

6 **(a)** A car tyre is inflated with air using a footpump. The mechanic using the footpump notices that the pump gets hot.

The air going into the tyre is warmed up by the pumping. Describe what happens to the motion of the air molecules as the air warms up.

.....

..... [1]

(b) Many forces act on a car tyre during a car journey.

State **three** effects that forces can have on an object.

1 .....

2 .....

3 .....

[2]

(c) Car brake lights (stop lights) light up when the driver presses on the footbrake pedal. The pedal acts as a switch.

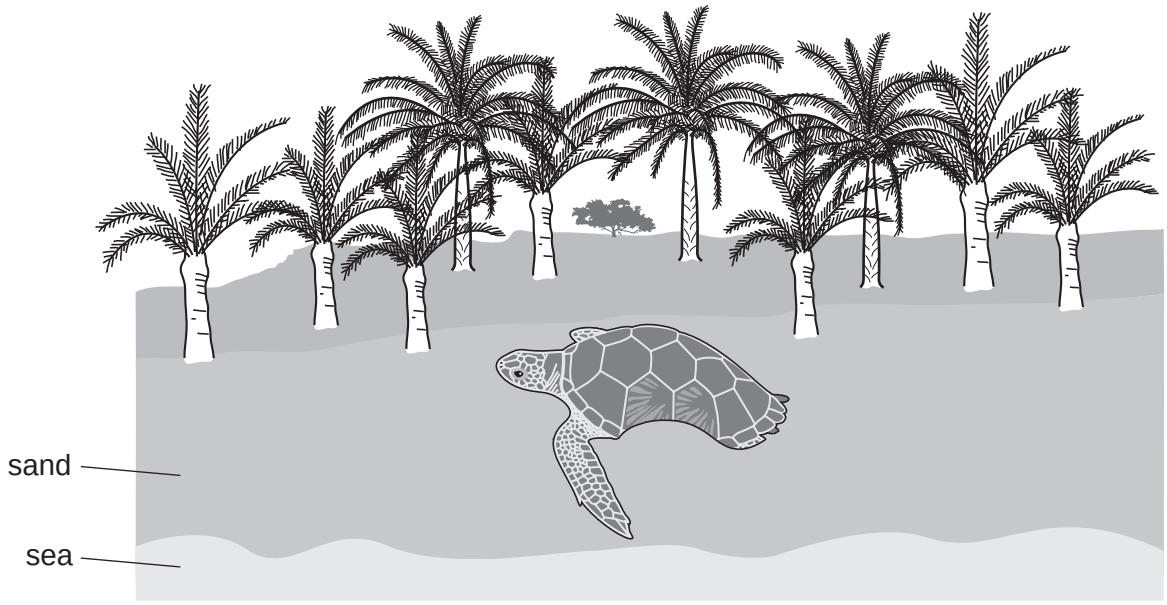
Draw a circuit diagram including a battery to show how this works.

Design your circuit so that, if one brake light fails, the other still lights up.

[4]

For Examiner's Use

7 Hawksbill turtles are an endangered species. Adults spend most of their lives at sea, but the females come ashore to lay their eggs. They bury their eggs in nests in the sand, either on a beach or in the vegetation that grows just behind the beach.



The sex of hawksbill turtles is determined by the temperature of the sand in which the eggs develop.

- At 29 °C, equal numbers of males and females develop.
- Higher temperatures produce more females.
- Lower temperatures produce more males.

There is concern that in recent years too many female turtles have been produced, and not enough males.

(a) Researchers measured the temperature, at a depth of 30 cm, in four different parts of a beach, on Antigua, where hawksbill turtles lay their eggs. The results are shown in Fig. 7.1. The tops of the bars represent the mean temperature.

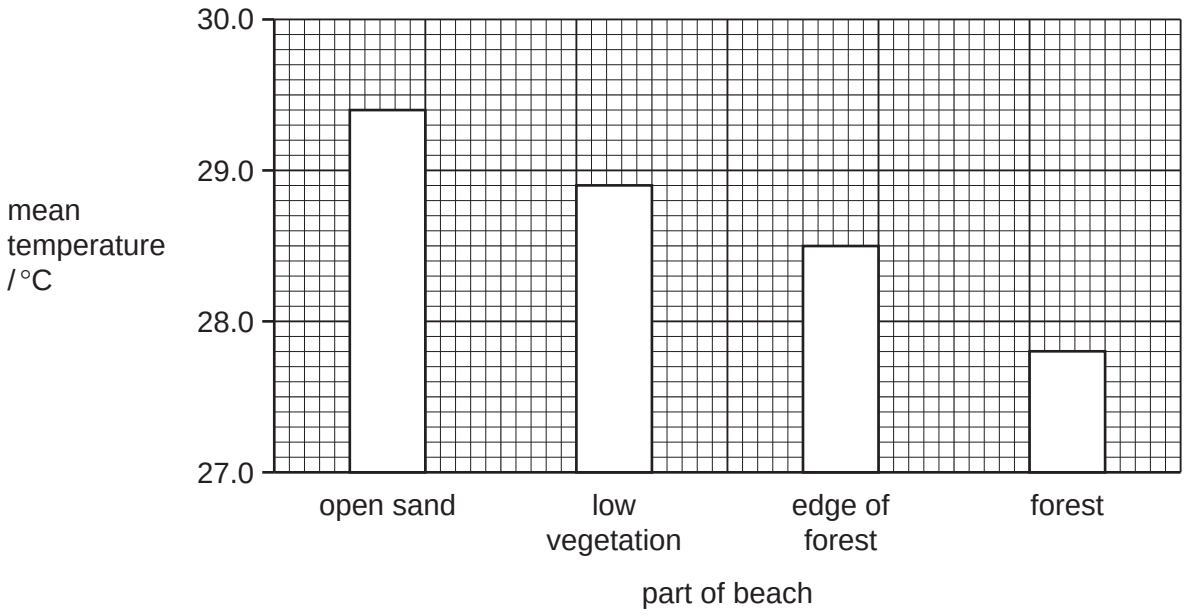


Fig. 7.1

With reference to Fig. 7.1, describe the effect of the presence of trees on the temperature of the sand.

.....

.....

..... [2]

(b) The researchers counted the proportion of male and female turtles hatching from nests in the four different parts of the beach. The results are shown in Table 7.1.

Table 7.1

part of beach	nests producing more males than females	nests producing more females than males	nests producing equal numbers of females and males
open sand	0	16	0
low vegetation	31	24	6
edge of forest	61	0	11
in forest	36	0	0

(i) State the part of the beach in which most female hawksbill turtles chose to lay their eggs.

..... [1]

(ii) Use the information in Fig. 7.1 to explain the results for nests in open sand and in forest, shown in Table 7.1.

.....

.....

..... [2]

(c) Tourism is an important industry in Antigua. The vegetation on many beaches has been cut down to make the beaches more attractive to tourists.

With reference to the results of this research, suggest how deforestation of beaches could affect hawksbill turtle populations.

.....

.....

..... [2]

(d) Describe **two** harmful effects to the environment, other than extinction of species, that may result from deforestation.

For Examiner's Use

1 .....

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2 .....

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[4]

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Please turn over for Question 8.

8 Fig. 8.1 shows apparatus a student used to investigate temperature changes that occurred during chemical reactions.

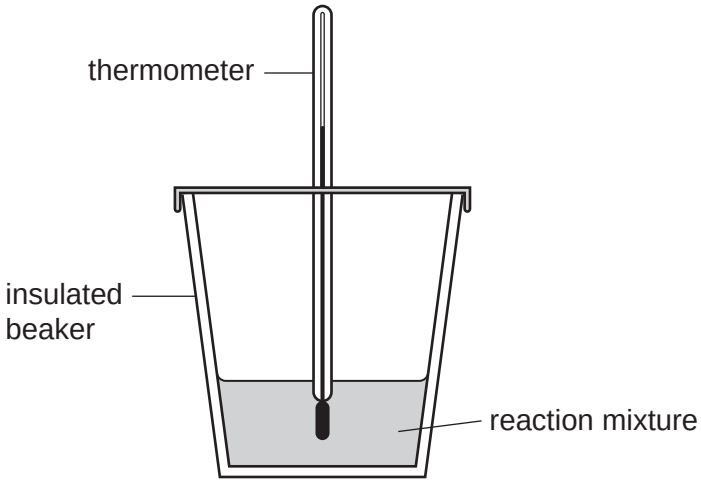

Fig. 8.1

The student added reactants to the insulated beaker and stirred the mixture. She recorded the final temperature of each mixture.

At the start of each experiment, the temperature of the reactants was 22 °C.

Table 8.1 contains the results the student obtained.

Table 8.1

experiment	reactant A	reactant B	final temperature / °C
1	dilute hydrochloric acid	sodium hydrogencarbonate	16
2	dilute hydrochloric acid	potassium hydroxide solution	26
3	magnesium	copper sulfate solution	43
4	copper	magnesium sulfate solution	22

(a) Explain which experiment, **1**, **2**, **3** or **4**, was a neutralisation reaction between an acid and an alkali.

experiment .....

explanation .....

..... [1]

(b) State and explain which experiment, **1**, **2**, **3** or **4**, was an endothermic reaction.

experiment .....

explanation .....

..... [1]

(c) Apart from the change in temperature, state **one** other observation the student could make when she carried out experiment **3**.

.....

..... [1]

(d) Explain, in terms of reactivity, why a reaction occurred in experiment **3**.

.....

..... [1]

(e) Suggest and explain a reason for the result obtained in experiment **4**.

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..... [2]

For Examiner's Use

9 **(a)** Fig. 9.1 shows the effect of pH on the activity of an enzyme.

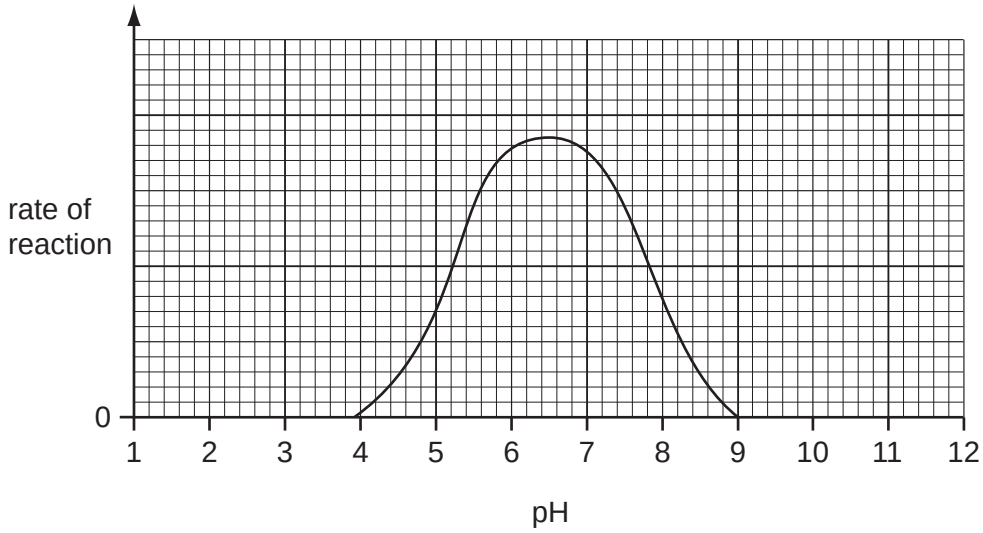

Fig. 9.1

(i) Describe the effect of pH on the activity of this enzyme.

.....

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..... [2]

(ii) Explain why pH affects the enzyme in this way.

.....

.....

..... [2]

(iii) An enzyme digests food in the human stomach, where hydrochloric acid is secreted. This enzyme is adapted to work best in these conditions.

On Fig. 9.1, sketch a curve to show how pH affects the activity of this stomach enzyme. [1]

(iv) After the food has been in the stomach for a while, it passes into the duodenum. Pancreatic juice, which contains sodium hydrogencarbonate, is mixed with the food in the duodenum.

Explain why this stomach enzyme stops working when it enters the duodenum.

.....

.....

..... [2]

(b) Explain how chemical digestion enables body cells to obtain nutrients.

For Examiner's Use

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..... [3]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
						1 **H** Hydrogen 1											4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

Key

a	a = relative atomic mass
X	**X** = atomic symbol
b	b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).