



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

October/November 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 **18** printed pages and **2** blank pages.



- 1 (a) Complete Table 1.1 by choosing one of the words from the list to match each statement.

ammeter ampere electron insulator
ohm volt voltmeter watt

Table 1.1

statement	word
a particle with a negative electrical charge	
an instrument that measures electrical current	
the unit of potential difference	
a material that does not conduct electricity	

[4]

- (b) Fig. 1.1 shows two circuits, **A** and **B**. All the lamps and both cells are the same.

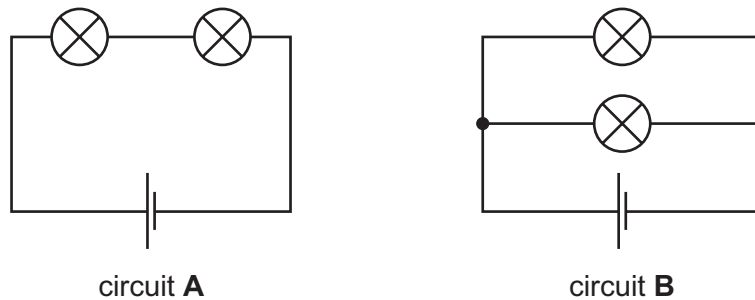


Fig. 1.1

- (i) One lamp is unscrewed from circuit **A**.

State what happens to the other lamp.

Explain your answer.

.....

[2]

(ii) Explain why lights in a house are connected as in circuit **B** and **not** as in circuit **A**.

.....
.....
..... [2]

(iii) The resistance of each lamp is 1.2Ω .

Calculate the combined resistance of the two lamps in circuit **A**.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

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2 (a) Fig. 2.1 shows part of the carbon cycle.

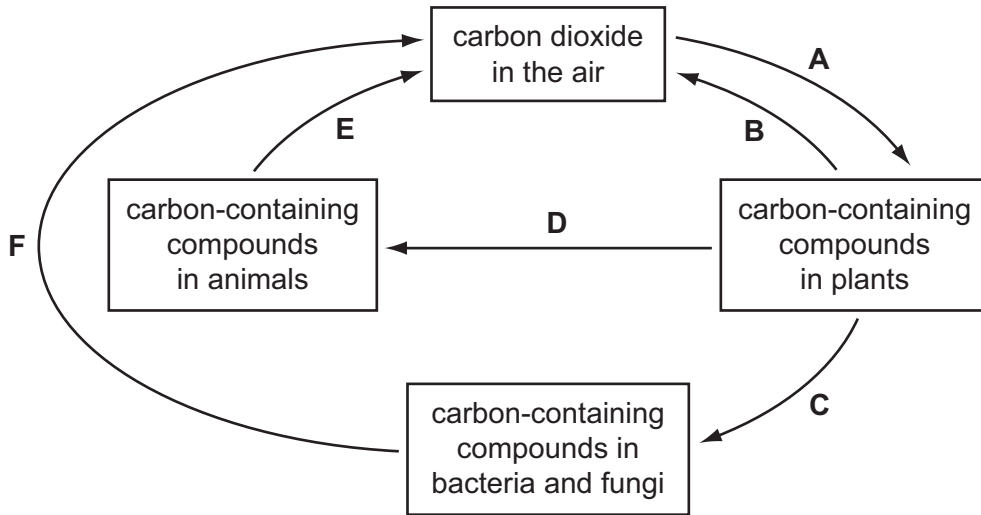


Fig. 2.1

(i) State the letter that represents photosynthesis in Fig. 2.1. [1]

(ii) State the **three** letters that represent respiration in Fig. 2.1.
 [1]

(iii) Name **one** carbon-containing compound in plants.
 [1]

(iv) State the approximate percentage of carbon dioxide in the air.
 [1]

(b) (i) Earthworms play an important part in the carbon cycle. They eat leaves, and egest material containing plant nutrients into the soil.

Explain the meaning of the term *egest*.

.....

 [2]

(ii) Underline the **two** words that describe the position of an earthworm in a food chain.

- carnivore consumer herbivore producer**

[1]

(iii) Fishermen catch large numbers of earthworms to use as bait.

There are concerns that too many earthworms are being collected.

Suggest why it is important to conserve earthworms.

.....

.....

..... [2]

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- 3 (a) Fig. 3.1 shows how a digital pH meter is used to measure the pH of some liquids.

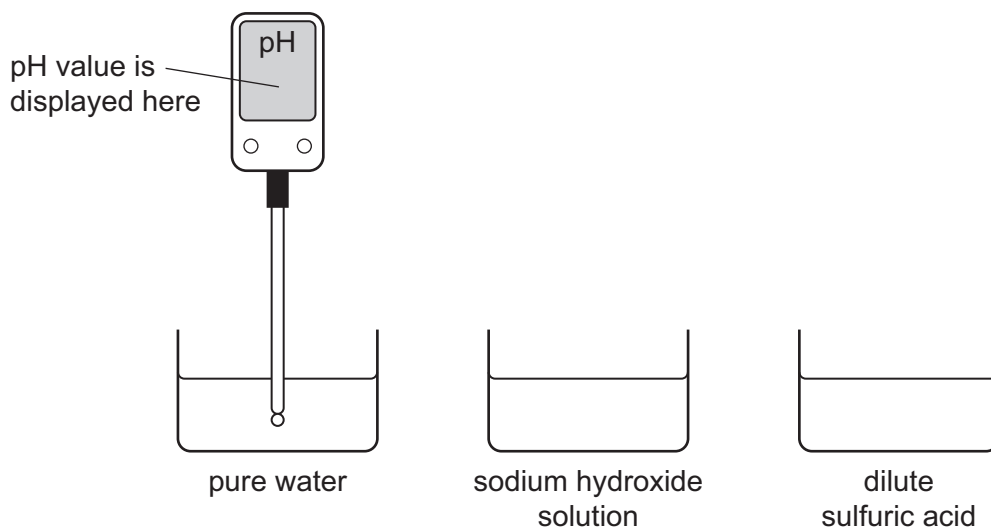


Fig. 3.1

- (i) Complete Table 3.1 by suggesting suitable pH values for the different liquids.

Table 3.1

liquid	pH
pure water	
sodium hydroxide solution	
dilute sulfuric acid	

[3]

- (ii) Suggest **one** advantage of using a digital pH meter rather than a piece of litmus paper to compare the acidity of two different acid solutions.

.....

 [1]

- (b) Describe how a student could use a solution of acidified silver nitrate to find out whether or not an unlabelled solution contains sodium chloride.

.....

 [2]

(c) When a reactive metal is added to a dilute acid, the metal reacts and dissolves and a gas is given off.

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(i) Name **one** reactive metal that must **not** be added to a dilute acid.

Explain why this metal should not be added to acid.

metal

explanation

..... [2]

(ii) Fig. 3.2 shows how a student tested the gas given off when magnesium was added to dilute hydrochloric acid.

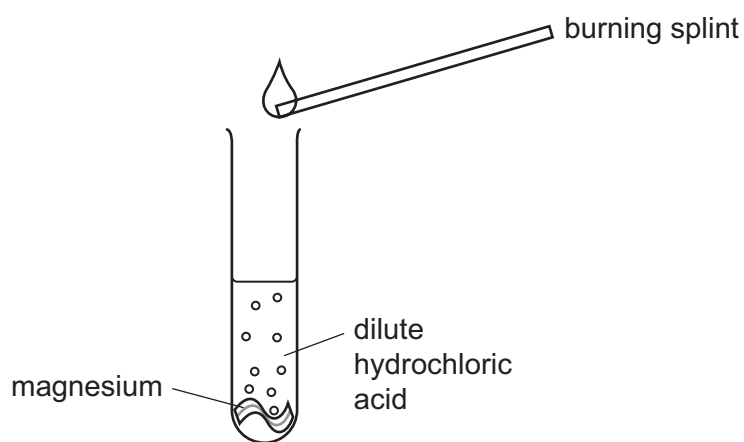


Fig. 3.2

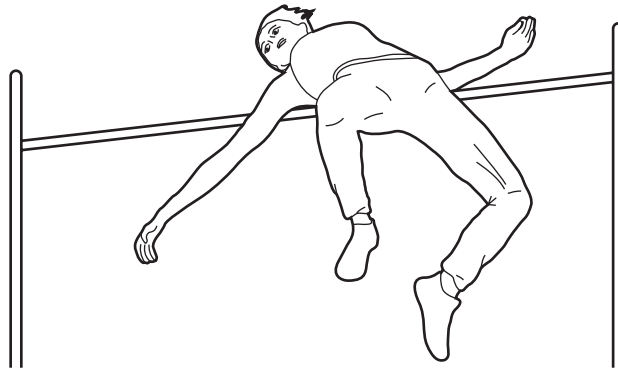
State and explain what the student observed when he carried out this test.

observation

explanation

[2]

4 An athlete competes in the high jump.



(a) Describe the energy changes that take place between the athlete taking off and landing after the high jump.

.....
.....
.....
..... [3]

(b) After jumping, the athlete is sweating.

(i) Describe, in terms of particles, how evaporation occurs from the surface of a liquid.

.....
.....
..... [2]

(ii) Explain how this process will cool down the athlete.

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

Please turn over for Question 5.

5 Table 5.1 shows some of the nutrients contained in 100 g of five foods.

Table 5.1

food	nutrients			
	sugar/g	starch/g	protein/g	fat/g
A	0	0	13	10
B	14	6	7	0
C	0	0	14	6
D	6	8	12	14
E	9	14	3	0

(a) (i) Which **two** nutrients listed in Table 5.1 are carbohydrates?

..... and [2]

(ii) Which nutrient listed in Table 5.1 contains nitrogen atoms in its molecules?

..... [1]

(iii) State the letters of **two** foods in Table 5.1 that could have come from animals.

..... and [1]

(iv) State the letter of **one** food that would appear orange-brown when tested with iodine solution, and give a purple colour when tested with biuret reagent.

..... [1]

(v) State the letter of the food that provides the most energy per 100g.

..... [1]

(b) Table 5.1 does **not** contain information about vitamins or minerals.

Outline the symptoms that a person may develop if their diet is deficient in

(i) vitamin D,

..... [1]

(ii) iron.

..... [1]

(c) Explain why eating a lot of foods containing sugar can increase the risk of tooth decay.

.....

.....

.....

.....

..... [3]

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- 6 Some types of firework are made by filling a cardboard tube with firework mixture. Firework mixture is made from several solid substances which have been powdered and mixed together.

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Fig. 6.1 shows a typical firework.

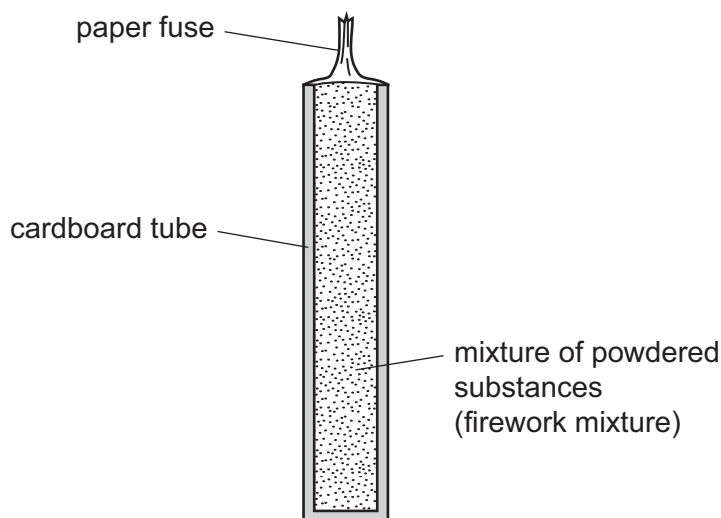


Fig. 6.1

When the paper fuse is lit, exothermic chemical reactions occur inside the firework.

- (a) (i) State **two** forms of energy that are released when the firework mixture reacts.

1

2

[2]

- (ii) State the effect on the rate of reaction of using firework mixture in the form of a powder.

..... [1]

(b) Some firework mixtures contain aluminium which is oxidised when the firework is lit.

Table 6.1 shows the numbers of protons and electrons in four particles, **A**, **B**, **C** and **D**, which are involved in the oxidation of aluminium.

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Table 6.1

particle	number of protons	number of electrons
A	8	10
B	13	13
C	8	8
D	13	10

(i) Atoms of the element aluminium have the proton number 13.

State and explain which particle, **B** or **D**, in Table 6.1 is an **atom** of aluminium.

particle

explanation

..... [1]

(ii) State and explain which **two** particles in Table 6.1 could be found bonded together in aluminium oxide.

particles and

explanation

.....

..... [3]

(c) Firework mixtures contain the compound potassium perchlorate, $KClO_4$.

When potassium perchlorate is heated, a colourless gas is given off which re-lights a glowing splint.

(i) State the name of this gas. [1]

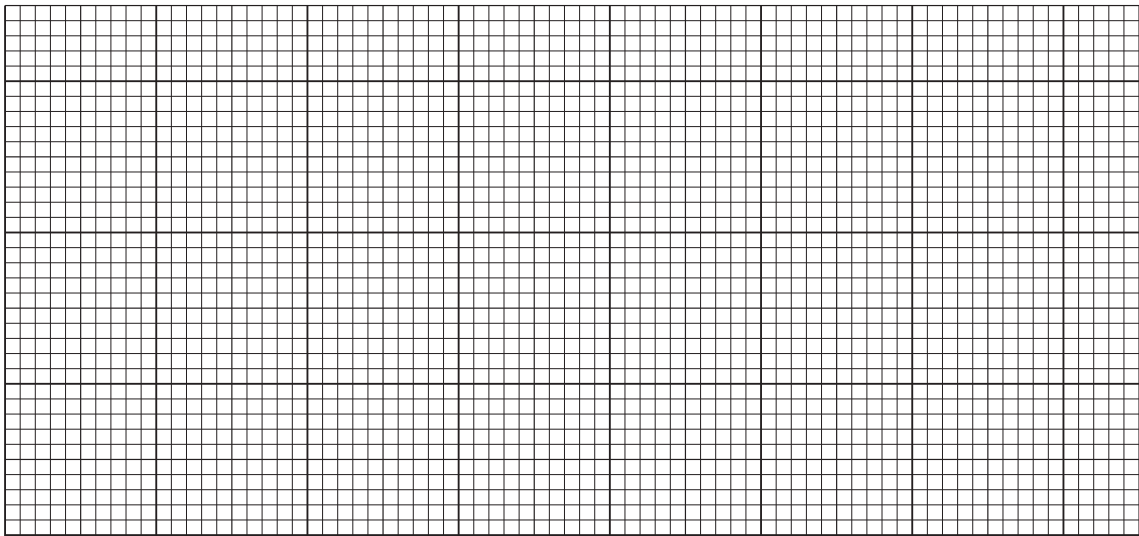
(ii) Suggest how potassium perchlorate in the firework mixture helps the mixture to burn.

.....

.....

..... [2]

- 7 (a) On the grid below, draw a wave with an amplitude of 2 cm and a wavelength of 4 cm.
On your diagram, clearly label the amplitude and the wavelength.



[3]

- (b) (i) Two sound waves, **A** and **B**, have the same frequency. **A** has a greater amplitude than **B**.

What difference would you hear?

..... [1]

- (ii) Two sound waves, **X** and **Y**, have the same amplitude. **X** has a greater frequency than **Y**.

What difference would you hear?

..... [1]

- (c) Energy travels to the Earth from the Sun.

State whether this transfer of energy is by conduction, convection or radiation.

Explain your answer.

.....
.....
..... [2]

8 Fig. 8.1 shows the male reproductive system.

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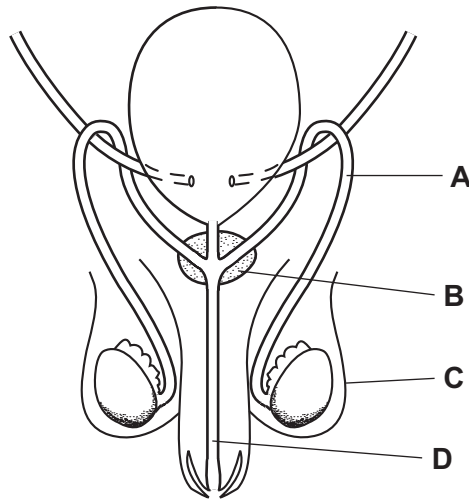


Fig. 8.1

(a) (i) Name parts C and D.

C

D

[2]

(ii) State the functions of parts A and B.

A

B

[2]

(iii) On Fig. 8.1, use a label line and the letter S to indicate where male gametes are made. [1]

(b) The human immunodeficiency virus (HIV) can be transmitted during sexual intercourse.

Outline **two** other ways in which HIV can be transmitted.

1

.....

2

..... [2]

9 Chlorine is released when hydrochloric acid reacts with the compound, manganese dioxide.

(a) (i) Explain why chlorine is an example of an *element* and **not** a *compound*.

.....

.....

.....

..... [2]

(ii) Describe a safe test for chlorine gas.

.....

..... [2]

(b) Chlorine is produced in the chemical industry by electrolysis.

A simplified diagram of the apparatus used to produce chlorine is shown in Fig. 9.1.

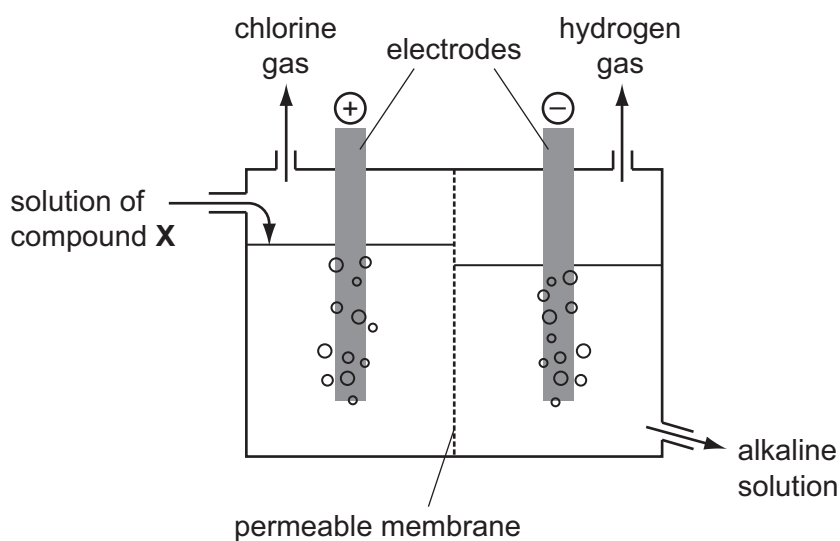


Fig. 9.1

(i) State the meaning of the term *anode*.

.....

..... [1]

- (ii) A student knows that compound **X** in Fig. 9.1 is either sodium hydroxide, NaOH, or sodium chloride, NaCl.

Using information from Fig. 9.1, deduce whether compound **X** is sodium hydroxide or sodium chloride.

Explain your answer.

X is

explanation

..... [1]

- (c) Chlorine is found in Group 7 of the Periodic Table. Two of the other elements in Group 7 are bromine and iodine.

- (i) Chlorine is a gas at room temperature.

What are the physical states of bromine and iodine at room temperature?

bromine

iodine [2]

- (ii) Explain briefly why a solution of sodium bromide turns orange when chlorine is bubbled through it.

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

		Group																										
I	II	III	IV	V	VI	VII	0																					
		1 H Hydrogen 1					4 He Helium 2																					
7 Li Lithium 3	9 Be Beryllium 4						20 Ne Neon 10																					
23 Na Sodium 11	24 Mg Magnesium 12	11 B Boron 5	12 C Carbon 6	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18																			
39 K Potassium 19	40 Ca Calcium 20	55 Mn Manganese 25	56 Fe Iron 26	57 Co Cobalt 27	58 Ni Nickel 28	59 Cu Copper 29	60 Zn Zinc 30	71 Ga Gallium 31	72 Ge Germanium 32	73 As Arsenic 33	74 Se Selenium 34	75 Br Bromine 35	76 Kr Krypton 36															
85 Rb Rubidium 37	86 Sr Strontium 38	91 Zr Zirconium 40	92 Nb Niobium 41	93 Mo Molybdenum 42	94 Tc Technetium 43	95 Ru Ruthenium 44	96 Rh Rhodium 45	97 Pd Palladium 46	98 Ag Silver 47	99 Cd Cadmium 48	100 In Indium 49	101 Sn Tin 50	102 Sb Antimony 51	103 Te Tellurium 52	104 I Iodine 53	105 Xe Xenon 54												
133 Cs Caesium 55	137 Ba Barium 56	181 Ta Tantalum 73	182 W Tungsten 74	183 Re Rhenium 75	184 Os Osmium 76	185 Ir Iridium 77	186 Pt Platinum 78	187 Au Gold 79	188 Hg Mercury 80	189 Tl Thallium 81	190 Pb Lead 82	191 Bi Bismuth 83	192 Po Polonium 84	193 At Astatine 85	194 Rn Radon 86													
226 Fr Francium 87	227 Ra Radium 88	228 Ac Actinium 89																										
													140 Ce Cerium 58	141 Pr Praseodymium 59	142 Nd Neodymium 60	143 Pm Promethium 61	144 Sm Samarium 62	145 Eu Europium 63	146 Gd Gadolinium 64	147 Tb Terbium 65	148 Dy Dysprosium 66	149 Ho Holmium 67	150 Er Erbium 68	151 Tm Thulium 69	152 Yb Ytterbium 70	153 Lu Lutetium 71		
													232 Th Thorium 90	233 Pa Protactinium 91	234 U Uranium 92	235 Np Neptunium 93	236 Pu Plutonium 94	237 Am Americium 95	238 Cm Curium 96	239 Bk Berkelium 97	240 Cf Californium 98	241 Es Einsteinium 99	242 Fm Fermium 100	243 Md Mendelevium 101	244 No Nobelium 102	245 Lr Lawrencium 103		

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

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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