UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8739348161

PHYSICAL SCIENCE **0652/21**

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 16.

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	
10	
Total	

This document consists of **16** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 Fig. 1.1 shows an uncalibrated liquid-in-glass thermometer.

Fig. 1.1

(a) (i) Name a suitable liquid to use in the thermometer.

..... [1]

(ii) State the physical property of the liquid on which the operation of the thermometer depends.

..... [1]

(b) (i) Explain what is meant by a *fixed point*.

.....

.....

..... [2]

(ii) What are the values of the fixed points on the Celsius temperature scale?

upper fixed point .....

lower fixed point ..... [2]

(c) The thermometer is to be calibrated.

The two fixed points are marked on the thermometer.

Describe the remaining stages in calibrating the thermometer.

.....

.....

..... [2]

For Examiner's Use

2 Chlorine is a member of Group VII of the Periodic Table.

(a) (i) State the name given to Group VII elements.

.....

[1]

(ii) Name a Group VII element which is less reactive than chlorine.

.....

[1]

(iii) Name the Group I element which is in the same Period as chlorine.

.....

[1]

(b) Complete Table 2.1 by giving the name and chemical formula of an ionic and a covalent compound of chlorine.

Table 2.1

compound	name	formula
ionic		
covalent		

[4]

3 Fig. 3.1 shows a man balancing on a tightrope.

For Examiner's Use

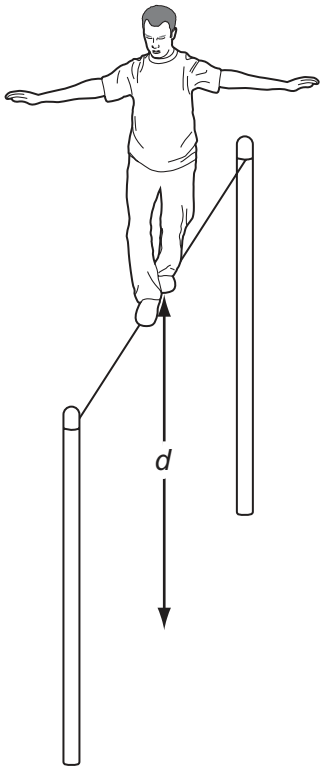

Fig. 3.1

(a) On Fig. 3.1 mark a possible position of the centre of mass of the man. Label it **C**. [1]

(b) The mass of the man is 75 kg.

(i) Explain what is meant by *mass*.

.....

..... [1]

(ii) Calculate the weight of the man.

[g = 10 N / kg]

weight = ... [2]

(c) The man jumps off the tightrope.

The graph in Fig. 3.2 shows his speed in a vertical direction after jumping.

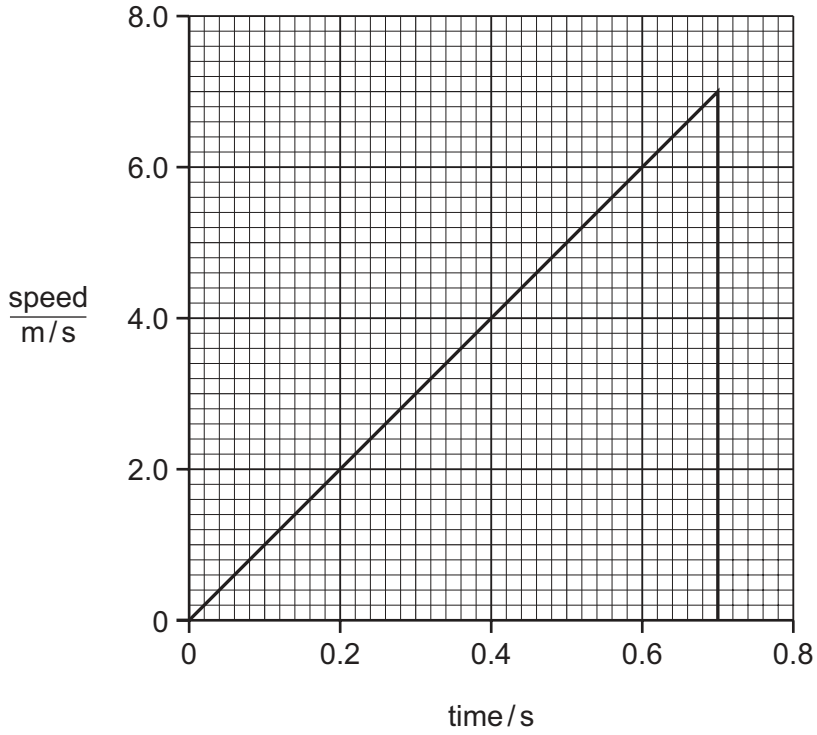

Fig. 3.2

Use Fig. 3.2 to find

(i) the maximum speed of the man,

speed = ... m/s [1]

(ii) the height, *d*, of the wire above the ground.

d = ... m [3]

(d) (i) Name the form of energy the man has due to his motion as he falls to the ground.

..... [1]

(ii) Suggest what happens to this energy when he hits the ground.

.....

.....

..... [2]

For Examiner's Use

4 Fig. 4.1 shows apparatus used to react copper(II) oxide with hydrogen.

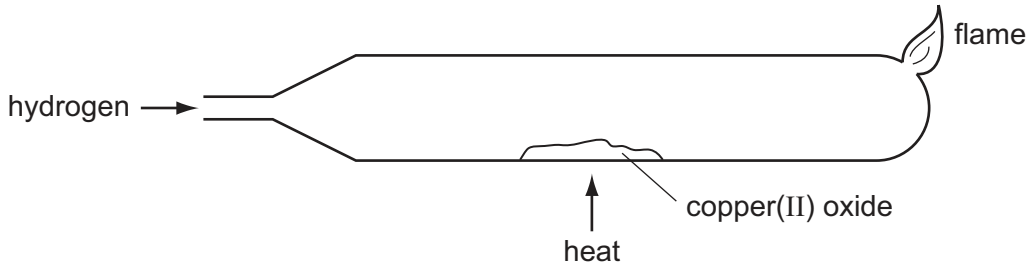

Fig. 4.1

(a) (i) Copper(II) oxide is black.

State the colour change you would see when copper(II) oxide is reduced to copper by hydrogen.

.....

..... [1]

(ii) Write a balanced equation for this reaction.

..... [1]

(iii) Explain what this reaction shows about the relative reactivity of copper and of hydrogen.

.....

..... [1]

(b) Describe how you could show that carbon (charcoal) is more reactive than copper and less reactive than magnesium.

.....

.....

.....

..... [3]

For Examiner's Use

5 Ammonium sulfate, $(NH_4)_2SO_4$, and ammonium nitrate, NH_4NO_3, are important nitrogen-containing fertilisers.

(a) Name **two** substances which react together to make ammonium nitrate.

1 .....

2 ..... [2]

(b) Calculate the relative molecular mass of ammonium sulfate.

[Relative atomic masses: A_r: H,1; N,14; O,16; S,32.]

answer ..... [2]

(c) Show by calculation that there is 35% nitrogen by mass in ammonium nitrate, NH_4NO_3.

[Relative molecular mass of ammonium nitrate is 80]

[2]

(d) Ammonium sulfate contains less nitrogen by mass than ammonium nitrate.

Suggest why ammonium sulfate is sometimes preferred as a fertiliser.

..... [1]

[Turn over

6 Fig. 6.1 shows the refraction of red light as it passes through a parallel sided glass block.

For Examiner's Use

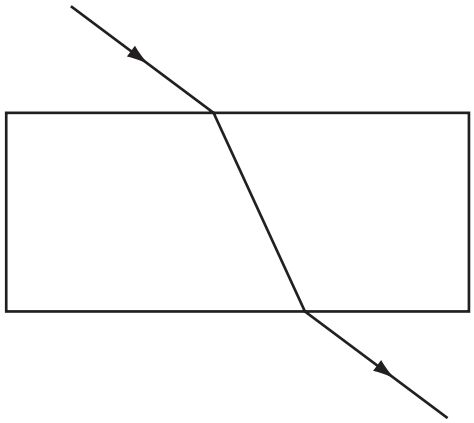

Fig. 6.1

(a) On Fig. 6.1 mark

(i) an angle of incidence and label it **i**, [1]

(ii) an angle of refraction and label it **r**. [1]

(b) Blue light refracts more than red light.

Blue light is shone along the same incident path as the red light.

On Fig. 6.1, draw the path of the blue light as it passes through the block and emerges into the air. [2]

(c) Fig. 6.2 shows a parallel beam of light incident on a converging lens.

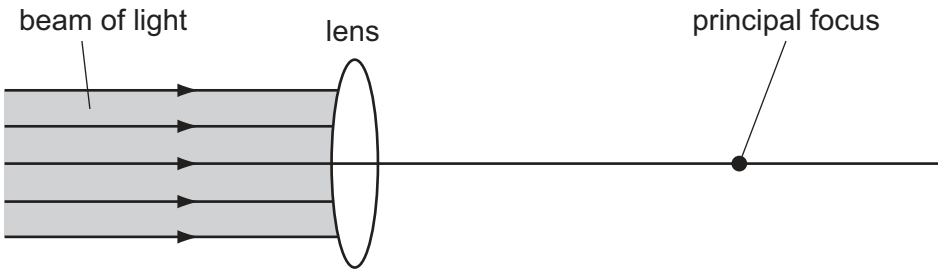

Fig. 6.2

(i) On Fig. 6.2 draw rays to show the path of the light after it passes through the lens. [3]

(ii) On Fig. 6.2 draw an arrow to show the focal length of the lens. [1]

(d) Powerful lenses are usually very thick.

Images formed by these lenses have coloured edges.

Suggest and explain a reason for this. You will find it helpful to use the information from parts **(b)** and **(c)** in your explanation.

.....

.....

..... [2]

For Examiner's Use

7 Danielle is investigating the resistance of a length of constantan wire.

She builds the circuit shown in Fig. 7.1.

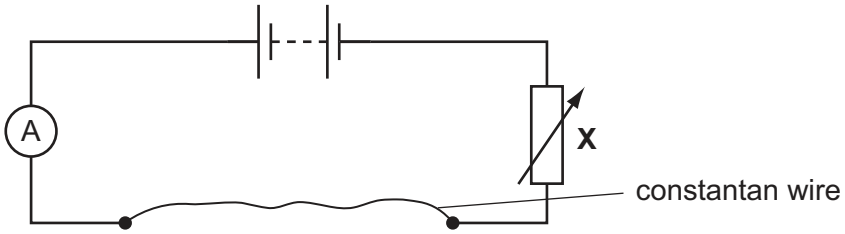

Fig. 7.1

(a) (i) Name the component labelled **X**. ..... [1]

(ii) Explain the use of this component in the circuit.

.....

..... [1]

(iii) On Fig. 7.1, show how Danielle should connect a meter to measure the potential difference across the wire. [2]

(b) When the potential difference across the constantan wire is 4.5 V, the reading on the ammeter is 0.12 A.

Calculate the resistance of the constantan wire.

resistance = ... unit ..... [3]

For Examiner's Use

(c) Danielle connects a second identical constantan wire in parallel with the original wire.

State how

(i) the total resistance in the circuit changes,

.....

[1]

(ii) the reading on the ammeter changes.

.....

[1]

(d) A third piece of constantan wire has the same length as the original wire but has a larger diameter.

State how the resistance of the third wire compares with the resistance of the original wire.

Give a reason for your answer.

.....

.....

.....

[2]

8 Fig. 8.1 shows apparatus used in an experiment to react hydrochloric acid with excess calcium carbonate to produce carbon dioxide.

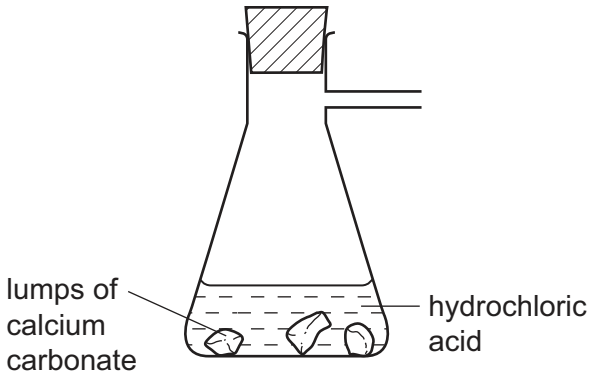

Fig. 8.1

(a) Complete Fig. 8.1 to show apparatus used to collect and measure the volume of the carbon dioxide. [2]

(b) Describe a test to show that the gas collected is carbon dioxide.

test .....

result ..... [2]

(c) Table 8.1 shows the volume of carbon dioxide collected during the experiment.

Table 8.1

time / minutes	volume of carbon dioxide collected / cm^3
0	0
1	15
2	26
3	34
4	40
5	40

(i) On Fig. 8.2, plot the results from Table 8.1. [1]

For Examiner's Use

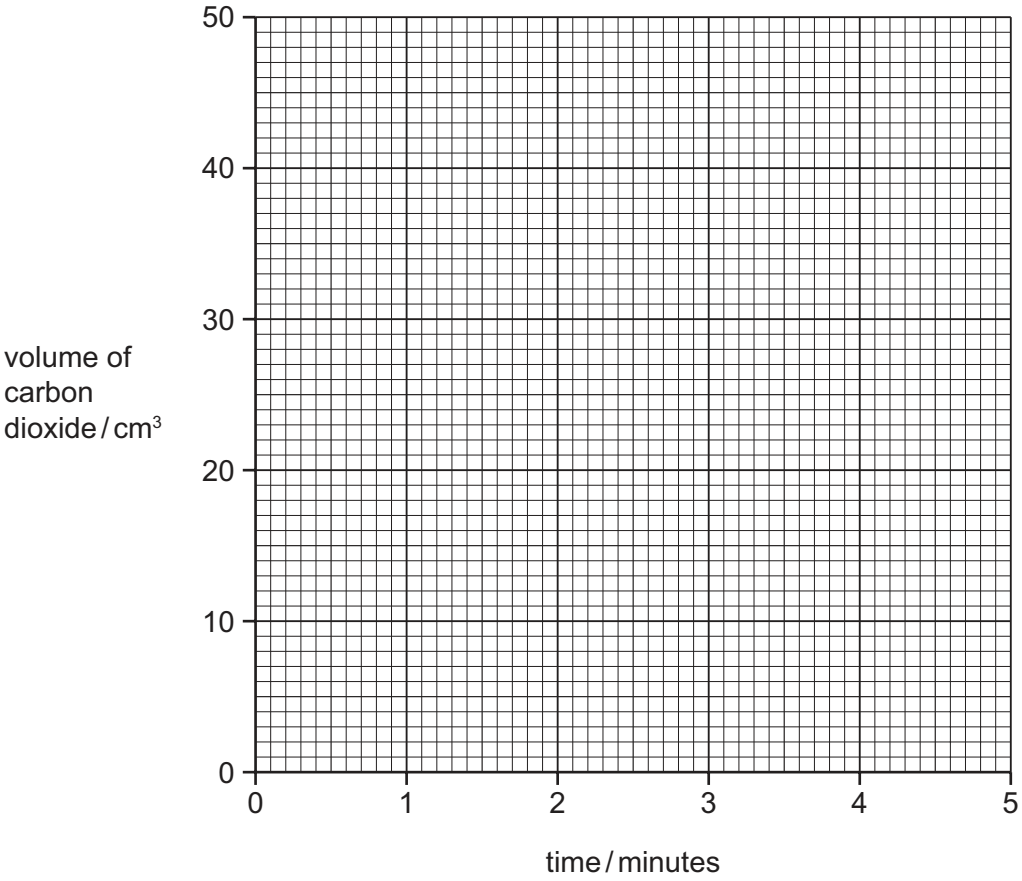

Fig. 8.2

(ii) On Fig. 8.2, draw the curve of best fit. [2]

(iii) Explain why the reaction stops after 4 minutes.

..... [1]

(iv) The experiment is repeated using the same mass of calcium carbonate. This time powder is used instead of lumps.

On Fig. 8.2, sketch the curve for this experiment. [2]

9 **(a)** Complete Table 9.1 to show the gases formed, if any, when each of the substances listed react with dilute sulfuric acid.

Table 9.1

substance added	gas, if any, formed
copper	
magnesium	
sodium carbonate	

[3]

(b) A salt is formed when a metal oxide neutralises an acid.

Complete the word equation for this reaction.

metal oxide + acid ⟶ salt + ... [1]

For Examiner's Use

10 (a) Fig. 10.1 shows the structure of the alkane, ethane.

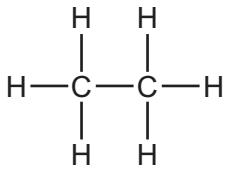

Fig. 10.1

Draw a similar diagram to show the structure of the alkene, ethene.

ethene [2]

(b) Name an alkane with four carbon atoms and give its formula.

name .....

formula ..... [2]

(c) (i) Explain why ethene is more reactive than ethane.

.....

..... [1]

(ii) Explain why ethene is important in the chemical industry.

.....

..... [1]

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											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 †															

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

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

Key: box showing a (top), **X** (centre), b (bottom left)

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

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