UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6563002991

PHYSICAL SCIENCE **0652/03**

Paper 3 (Extended) **October/November 2008**

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	
Total	

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

UNIVERSITY of CAMBRIDGE International Examinations

1 Fig. 1.1 shows a 0.20 kg mass hanging on a spring.

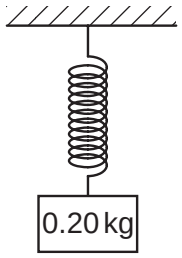

Fig. 1.1

(a) (i) Calculate the weight of the mass.
(g =10 N / kg)

Show your working.

weight = ...

(ii) Write down the force acting on the mass due to the spring.

force = ... [3]

(b) The mass is pulled down 1.5 cm and released.

Draw an arrow on the diagram and label it F, to show the direction of the resultant force on the mass immediately after it is released. [1]

The graph in Fig. 1.2 shows the results of an experiment in which different load... attached to the spring.

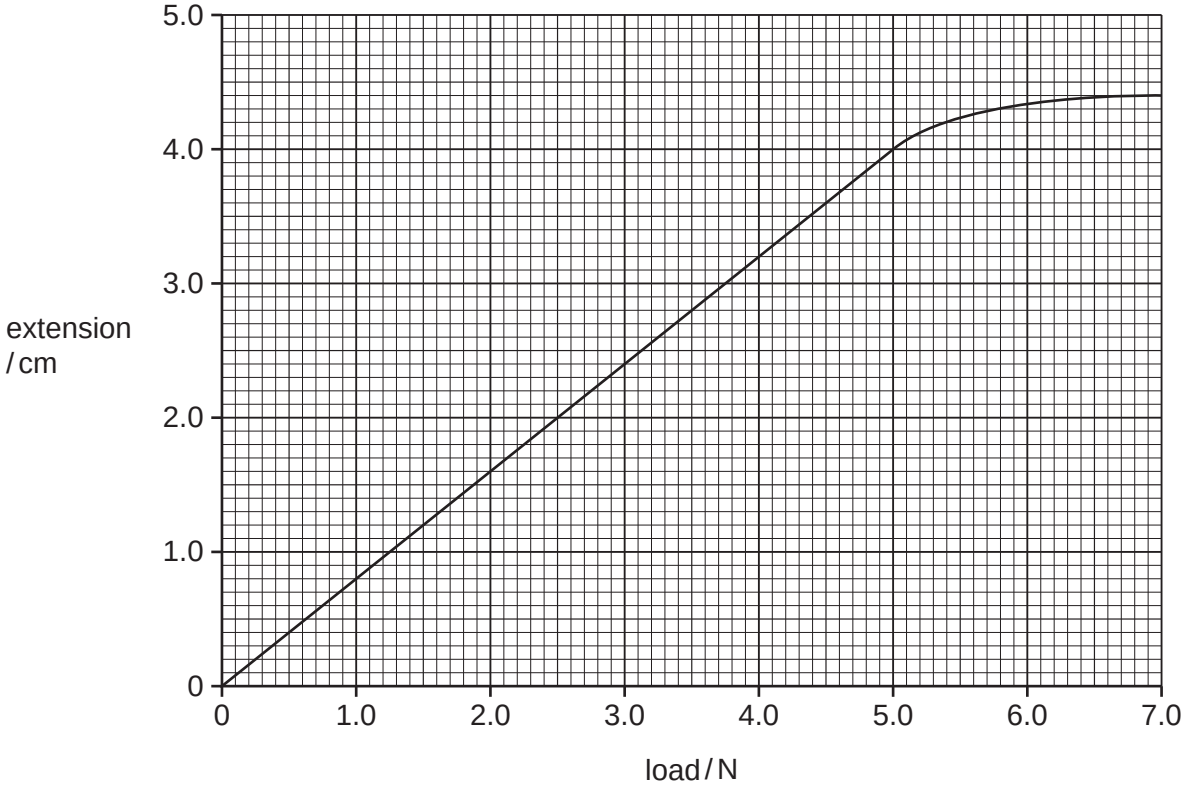

Fig. 1.2

(c) On the graph, mark the limit of proportionality and label it **P**. [1]

(d) **(i)** Use the graph to find the resultant force when the mass is pulled down by 1.5 cm.

resultant force = ...

(ii) Calculate the initial acceleration of the mass when it is released.

acceleration = ... [3]

2 Metal greenhouse frames, as shown in Fig. 2.1, are usually made of steel or aluminium.

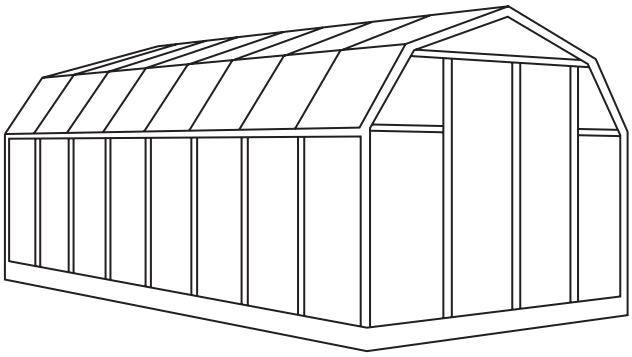

Fig. 2.1

(a) A disadvantage of using steel for a greenhouse frame is that it rusts when in contact with water and air.

This problem can be overcome by galvanising the steel.

(i) Explain what is meant by the term *galvanising*.

.....

..... [1]

(ii) Galvanising stops steel from rusting, even if the protective coating is scratched to expose the steel underneath.

Explain why.

.....

.....

.....

..... [3]

(iii) Describe another method that could be used to prevent the steel frame rusting.

.....

..... [1]

(iv) Does this method protect the steel frame as well as galvanising?

Explain your answer.

.....

..... [1]

(b) An aluminium greenhouse frame does not corrode as quickly as steel.

Explain why.

.....

.....

..... [2]

(c) Aluminium is also used to make aircraft bodies.

For this use aluminium is alloyed with other metals.

(i) What effect does alloying have on the properties of aluminium that make it more useful for aircraft construction?

.....

..... [1]

(ii) Explain why alloying has this effect.

.....

.....

..... [2]

3 Fig. 3.1 shows a liquid-in-glass thermometer.

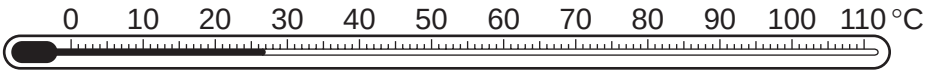

Fig. 3.1

(a) Explain what happens to the liquid when the thermometer is placed in a beaker of hot water.

.....

.....

..... [2]

(b) Fig. 3.2 shows another type of thermometer, known as a thermocouple.

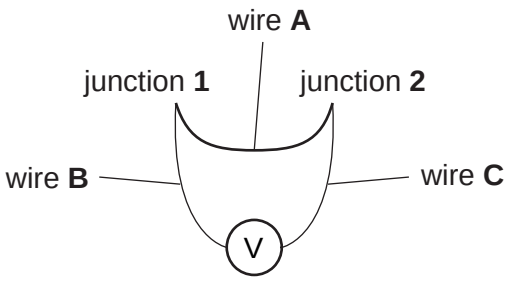

Fig. 3.2

(i) Name suitable materials for

wire **A** .....

wires **B** and **C** ..... [2]

(ii) Junction **1** is placed in melting ice. Junction **2** is placed in boiling water. The voltmeter reads 7.2 mV.

Junction **2** is then placed in a beaker of water. The voltmeter reading falls to 4.8 mV. Calculate the temperature of the beaker of water.

Show your working.

temperature ..... [2]

(iii) State and explain **one** advantage that the thermocouple has over the liq
glass thermometer.

.....

.....

..... [2]

4 **(a)** Complete Table 4.1 to show the arrangement of electrons in atoms of these elem

The first one has been done for you.

Table 4.1

element	electron arrangement			
Mg	2	8	2	
K				
Ar				
N				

[3]

(b) Describe the relationship between the electron arrangement of the atoms of an element and the position of that element in the Periodic Table.

.....

.....

..... [2]

(c) Elements in Group 7 are called halogens. Table 4.2 gives some information about the physical properties of three halogens.

Table 4.2

halogen	proton number	melting point / °C	boiling point / °C	colour
chlorine	17	−101	−35	pale green
bromine	35	−7	59	deep red
iodine	53	114	184	dark grey

(i) Calcium forms ions with the formula Ca^{2+}. Iodine forms ions with the formula I^-.

What is the formula of calcium iodide?

..... [1]

(ii) The element below iodine in this Group is astatine.

Suggest the colour of astatine.

.....[1]

(d) Table 4.3 gives information about four elements in Group 0 of the Periodic Table, called the noble gases.

Table 4.3

element	proton number	melting point / °C	boiling point / °C	density of gas in kg / m^3
helium	2	−272	−269	0.17
neon	10	−248	−246	0.84
argon	18	−189	−186	1.67
krypton	36	−157	−152	3.50

(i) Describe the trend in boiling point for elements in Group 0.

.....

.....[2]

(ii) The density of air is 1.20 kg/m^3.

Helium is used in airships and weather balloons. The other noble gases are not.

Use data from the table to suggest why.

.....

.....

.....

.....[3]

5 **(a)** Fig. 5.1 shows a ripple tank with three wavefronts approaching an area of s
water.

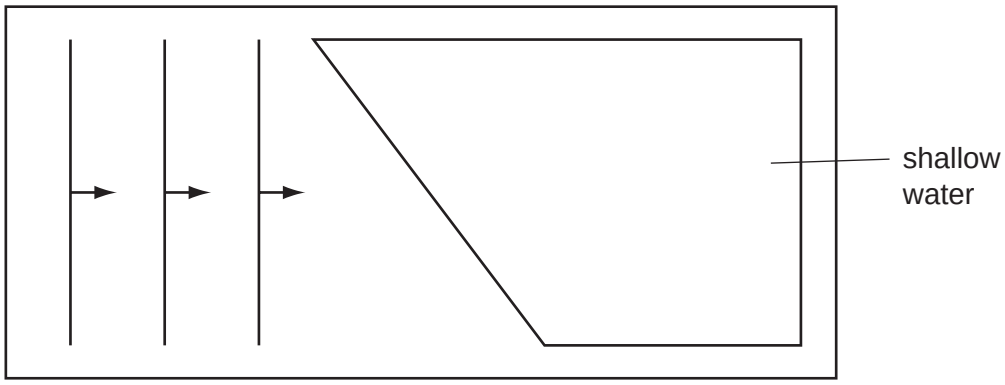

Fig. 5.1

On Fig. 5.1, draw four more wavefronts to complete the diagram. [3]

(b) Fig. 5.2 shows a similar ripple tank, with three wavefronts approaching a gap in a barrier.

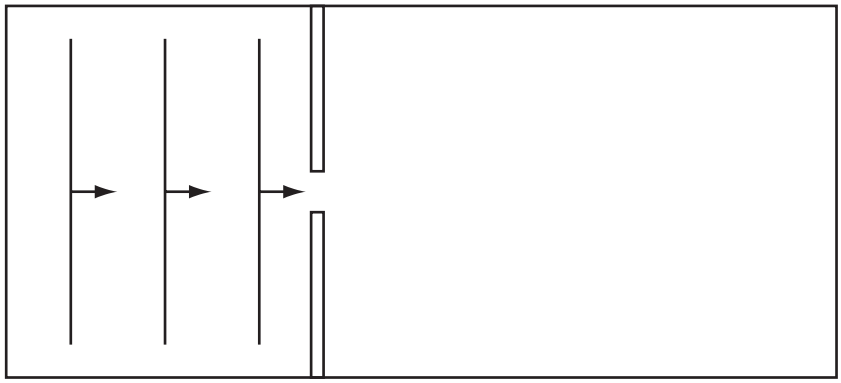

Fig. 5.2

(i) On Fig. 5.2, draw four wavefronts after they pass through the gap. [3]

(ii) Name the process being demonstrated.

..... [1]

6 When petrol is burned in a car engine, pollutant gases are produced.

(a) In the car engine nitrogen and oxygen combine to form oxides of nitrogen, includi
nitrogen monoxide, NO.

(i) Describe the problems caused by release of oxides of nitrogen into the air.

.....

.....

..... [2]

(ii) To reduce the quantity of oxides of nitrogen released into the air, modern cars are fitted with catalytic converters.

Explain how a catalytic converter removes nitrogen oxide from car exhaust gases.

.....

.....

..... [2]

(b) Propane can be used as an alternative fuel to petrol.

Propane burns according to the following equation.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

Calculate the mass and volume, at room temperature and pressure, of carbon dioxide produced by the complete combustion of 1.0 kg of propane.

Show your working.

[A_r: C, 12; H,1; O,16.]
[At room temperature and pressure 1 mole of any gas has a volume of 24 dm^3.]

mass of carbon dioxide = ... kg

volume of carbon dioxide = ... dm^3 [5]

(c) Carbon dioxide is a covalent compound.

Draw a diagram to show the arrangement of outer electrons in a molecule of carbon dioxide.

[3]

7 Ethene is reacted with steam to make ethanol.

(a) Describe how ethene is obtained.

.....

..... [2]

(b) Write a balanced equation for the reaction between ethene and steam.

..... [2]

(c) Complete this sentence to describe the conditions used for this reaction.

Ethene and steam are mixed at high pressure in the presence of

..... [1]

8 A nuclear power station supplies 200 000 kW to the National Grid at 55 000 V.

(a) Calculate the current from the power station.
Show your working.

current = ... [3]

(b) The energy is transmitted across the country at this voltage. It is stepped down to 250 V for domestic use.

(i) Explain why the energy is transmitted at a very high voltage.

.....

.....

.....

.....

(ii) Name the device used to step down the voltage. .....

(iii) Calculate the turns ratio required to step the voltage down from 55 000 V to 250 V.
Show your working.

primary turns : secondary turns

..... : ..... [5]

(c) A transformer is described as 100% efficient.
Explain what is meant by this statement.

.....

..... [1]

9 The iodine isotope, $^{131}_{53}\mathrm{I}$, decays by emitting a β–particle.

(a) Explain what is meant by a β–particle.

.....

..... [2]

(b) **(i)** Complete the equation which describes the decay.

$$^{131}_{53}\mathrm{I} = \,^{\cdots\cdots}_{\cdots\cdots}\mathrm{X} + \,^{\cdots\cdots}_{\cdots\cdots}\beta$$

(ii) Use the Periodic Table, on page 16, to identify the element X and comment on its reactivity.

.....

..... [4]

(c) This isotope has a half-life of 8.1 days and is used in medical diagnosis and treatment.

Suggest why the isotope is suited for this purpose.

.....

..... [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											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 Sulphur 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 X b

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.).