UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

6304641213

PHYSICAL SCIENCE **0652/03**

Paper 3 (Extended) **October/November 2007**

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 **14** printed pages and **2** blank pages.

For Examiner's Use

1 Fig. 1.1 shows the speed of a car as it moves along a straight, level track.

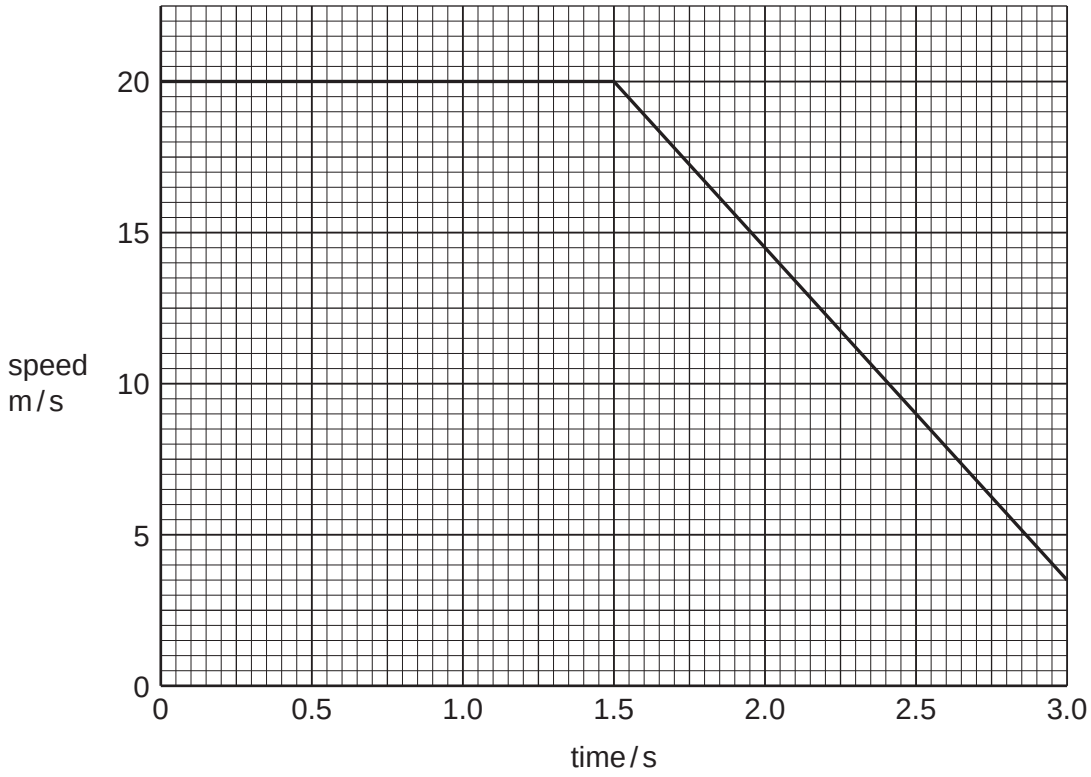

Fig. 1.1

(a) During the first 1.5 s the car travels at a constant speed.
State the overall force on the car during this period of time.

force = ... [1]

(b) Calculate the acceleration of the car between 1.5 s and 3.0 s.

acceleration = ... [3]

(c) The mass of the car is 1200 kg.
Calculate the braking force on the car between 1.5 s and 3.0 s.

force = ... [2]

For Examiner's Use

2 Fig. 2.1 shows a view from above as a set of ripples move out from a point when a stone is thrown into a pond.

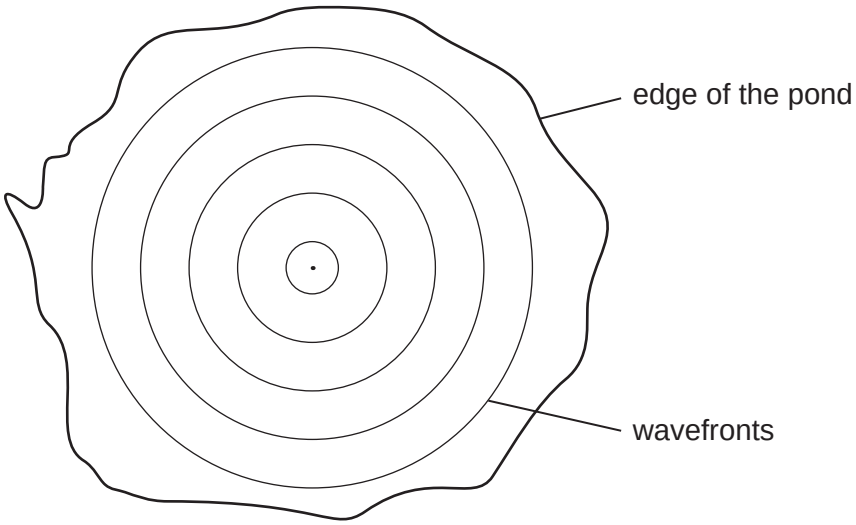

Fig. 2.1

(a) (i) Mark on Fig. 2.1 one wavelength and label it λ.

(ii) A boy counts 12 waves hitting the bank in 5.0 s.
Calculate the frequency of the waves.

frequency = ...

(iii) The wavelength of the waves is 0.40 m.
Calculate the speed at which the waves move.

speed = ... [5]

(b) The water is shallower near the bank and the waves slow down.
Suggest what effect that this will have on

(i) the wavelength of the waves, ...

.....

(ii) the frequency of the waves. .....

..... [2]

For Examiner's Use

3 A student reacts the same mass of calcium carbonate with excess of the same hydrochloric acid solution at different temperatures.

At each temperature he measures the time taken for all of the calcium carbonate to react.

His results are shown in Fig. 3.1.

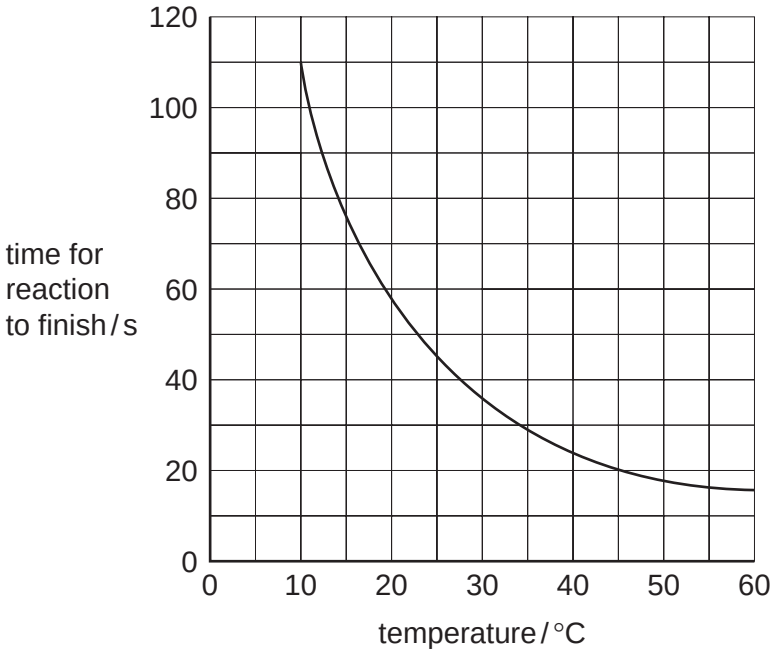

Fig. 3.1

(a) (i) Describe the effect of change in temperature on the rate of this reaction.

.....

..... [2]

(ii) State two other factors that may affect the rate of a reaction.

1. .....

2. ..... [2]

For Examiner's Use

(b) At a higher temperature the particles have more energy to react.

Energy may also be supplied by light. This happens in the process called photosynthesis.

(i) Plants use photosynthesis to make glucose.

Name the reactants and the other product of photosynthesis.

reactants

..... and .....

other product

..... [3]

(ii) What enables the energy from sunlight to be absorbed in this process?

..... [1]

(iii) The process is speeded up by the presence of an enzyme.

What is an *enzyme*?

.....

..... [2]

(c) Energy from light is also used in photography.

Photographic film contains the compound silver bromide. When light falls on the film a photochemical reaction takes place.

Silver metal is formed, creating a black area on the film.

What type of reaction have the silver ions undergone?

..... [1]

For Examiner's Use

4 Fig. 4.1 shows a ray of light entering a parallel sided glass block.

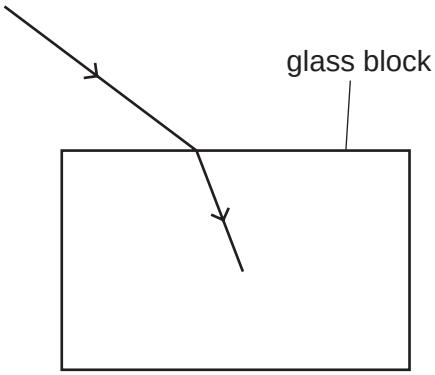

Fig. 4.1

(a) Complete the path of the light through and as it leaves the block. [1]

(b) Calculate the value of the angle of refraction if the glass has a refractive index of 1.54 and the angle of incidence is 53.1°.

Show your working.

angle of refraction = ... [4]

For Examiner's Use

5 Copper and aluminium are two commonly used metals.

(a) Copper is a metal that can be found 'native'.

(i) Explain this meaning of the term *native*.

.....

..... [1]

(ii) Name **one** other metal that is commonly found native.

..... [1]

(iii) Complete Table. 5.1 to show two uses of copper and the properties on which these uses are based.

Table 5.1

use of copper	property of copper

[4]

(b) Aluminium is not found native. It is found as a compound.

(i) The main ore of aluminium contains the compound aluminium oxide.

Name this ore.

..... [1]

(ii) Aluminium foil is used for food containers.

Aluminium is a fairly reactive metal, but aluminium foil does not react with food.

Explain why.

.....

..... [1]

(iii) State another use of aluminium, and explain why it is a good metal for this use.

use .....

explanation .....

..... [2]

For Examiner's Use

6 Fig. 6.1 shows a design for a battery charger, which is made up from a transformer and component **P**.

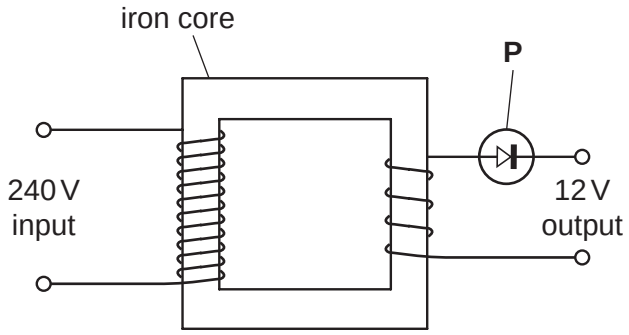

Fig. 6.1

(a) (i) Name component **P**.

.....

(ii) Explain why **P** is needed in the circuit.

.....

.....

..... [3]

(b) Explain how the transformer converts an input voltage into a different output voltage.

.....

.....

.....

..... [4]

(c) The primary coil has 1800 turns.
Calculate the number of turns in the secondary coil.

number of turns = ... [3]

(d) A battery takes 3 hours to charge with an average current of 200 mA.
Calculate the total charge delivered.

charge = ... [2]

For Examiner's Use

7 Table 7.1 gives information about some of the elements in Group II of the Periodic Table.

Table 7.1

element	atomic number	formula of oxide	melting point in °C	reaction with cold water
magnesium	12	MgO	649	slow
calcium	20	CaO	839	steady
strontium	38	SrO	769	rapid
barium	56	BaO	725	

(a) Three of these elements show a trend in a **physical** property.

(i) Describe this physical trend.

.....

..... [2]

(ii) Which element does not fit in with this trend?

..... [1]

(b) The elements in Table 7.1 show a trend in a **chemical** property.

Describe this chemical trend.

.....

..... [2]

(c) When a small piece of calcium is added to cold water, a steady stream of bubbles is given off. This is hydrogen gas.

When the reaction is completed, a test with Universal Indicator shows the water to have a pH of 12. Calcium hydroxide has been formed.

(i) Write a balanced symbol equation for the reaction of calcium with cold water.

..... [2]

(ii) What does the test with Universal Indicator show about the properties of calcium hydroxide?

..... [1]

(iii) What would you **see** when a small piece of barium is added to cold water?

.....

..... [2]

8 Fig. 8.1 shows the structure of a cathode ray tube.

For Examiner's Use

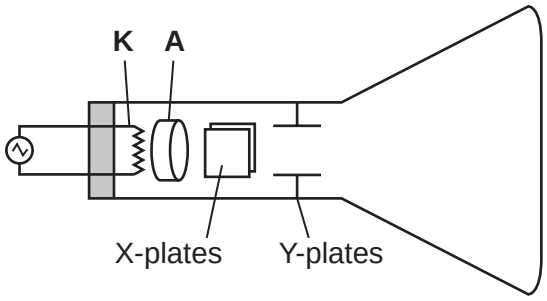

Fig. 8.1

(a) Explain how parts **K** and **A** produce cathode rays.

.....

.....

.....

.....

..... [4]

(b) Fig. 8.2 shows an experiment to measure the speed of sound.
Two microphones are placed 8.0 m apart and connected to a cathode ray oscilloscope.
A loudspeaker is placed in front of them.

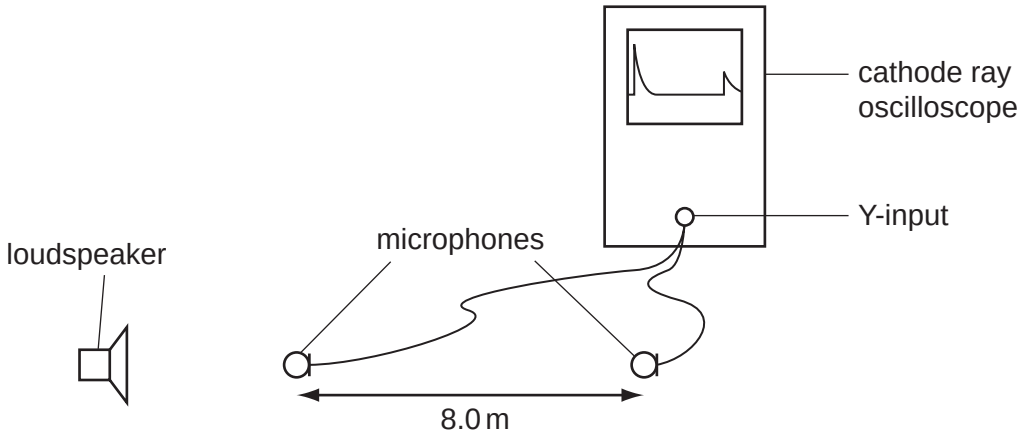

Fig. 8.2

The loudspeaker produces a sharp pulse of sound which is detected by the microphones and displayed on the cathode ray oscilloscope screen.

Fig. 8.3 shows the screen in more detail. The time base is set to 5 ms / square.

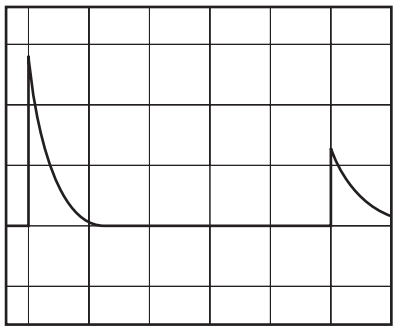

Fig. 8.3

(i) What is the time interval between the pulses received from the two microphones?

time = ...

(ii) Calculate the speed of the sound.

speed = ... [3]

[Turn over

For Examiner's Use

9 Copper(II) oxide reacts with dilute sulphuric acid according to the following equation.

$$CuO + H_2SO_4 \longrightarrow CuSO_4 + H_2O$$

A student uses this reaction to prepare crystals of copper(II) sulphate.

(a) To make sure that the crystals are pure, an excess of copper(II) oxide must be used.

(i) Explain why an excess of copper(II) oxide must be used to ensure purity of the crystals.

.....

..... [1]

(ii) The student uses 10.0 g of copper(II) oxide and 100 cm^3 of 1.0 mol / dm^3 sulphuric acid.

Show by calculation that the copper(II) oxide is in excess.

[A_r: Cu, 64; O,16.]

[4]

(b) Describe how the student should carry out the preparation to obtain pure, dry crystals of copper(II) sulphate.

.....

.....

.....

.....

.....

.....

.....

..... [4]

For Examiner's Use

10 Fig. 10.1 shows the apparatus used to identify the radioactive emissions from different isotopes

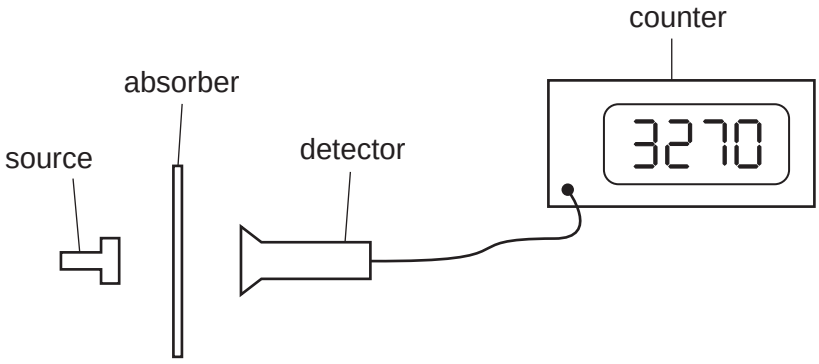

Fig. 10.1

Table 10.1 shows the count obtained in 2 minutes from an isotope of the element americium, using different absorbers.

Table 10.1

count with no absorber	count with paper absorber	count with aluminium absorber	count with lead absorber
5854	1649	1644	103

State, with reasons, the type or types of radiation emitted by the source.

.....

.....

.....

..... [3]

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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.).