UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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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	
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10	
Total	

This document consists of **14** printed pages and **2** blank pages.

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

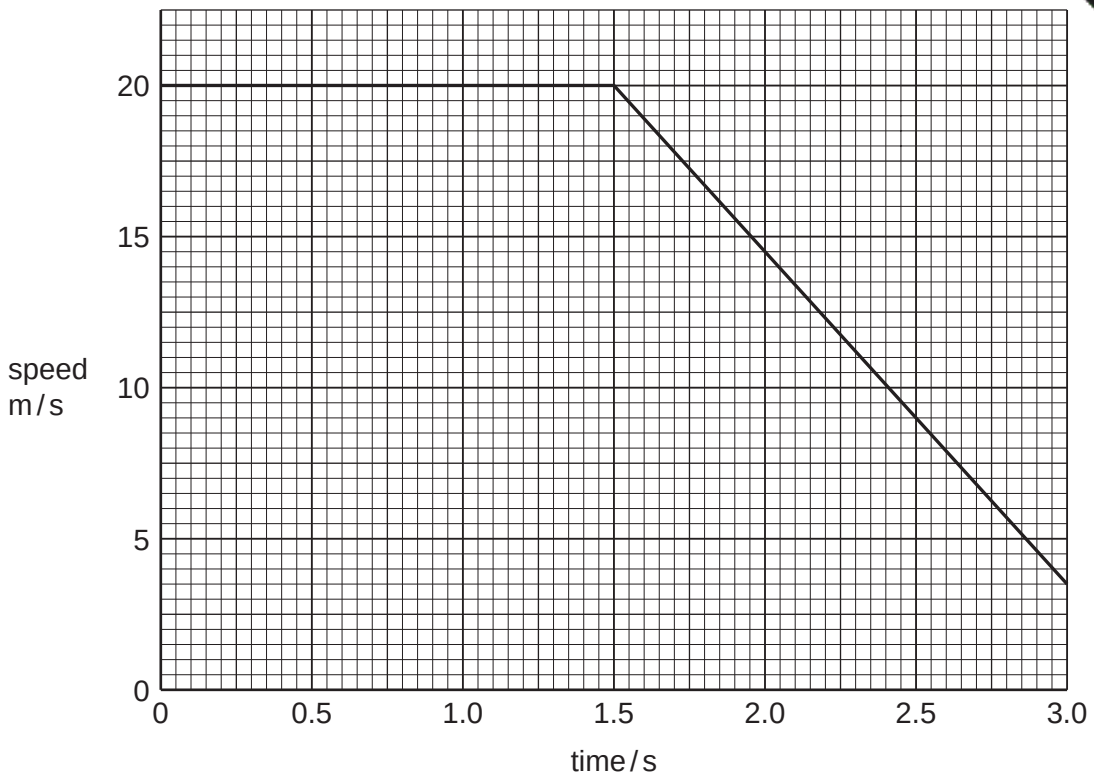

Fig. 1.1

(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]

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

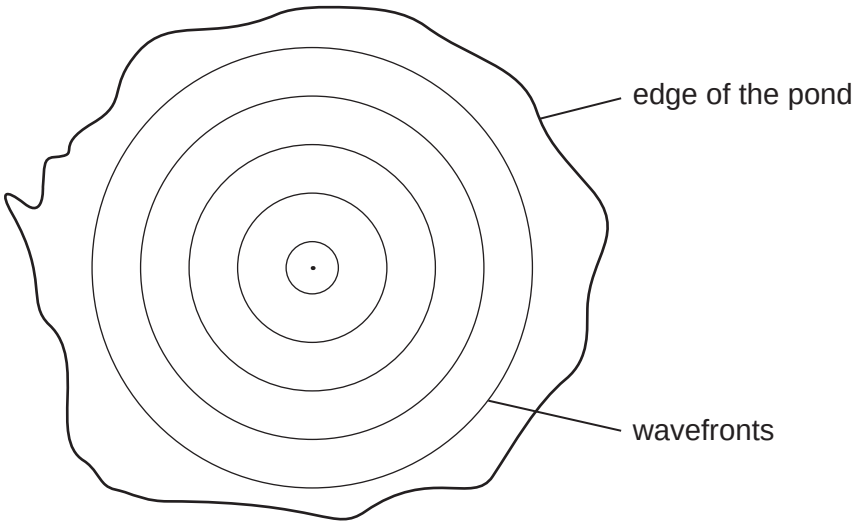

Fig. 2.1

(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]

3 A student reacts the same mass of calcium carbonate with excess of the same hydro
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.

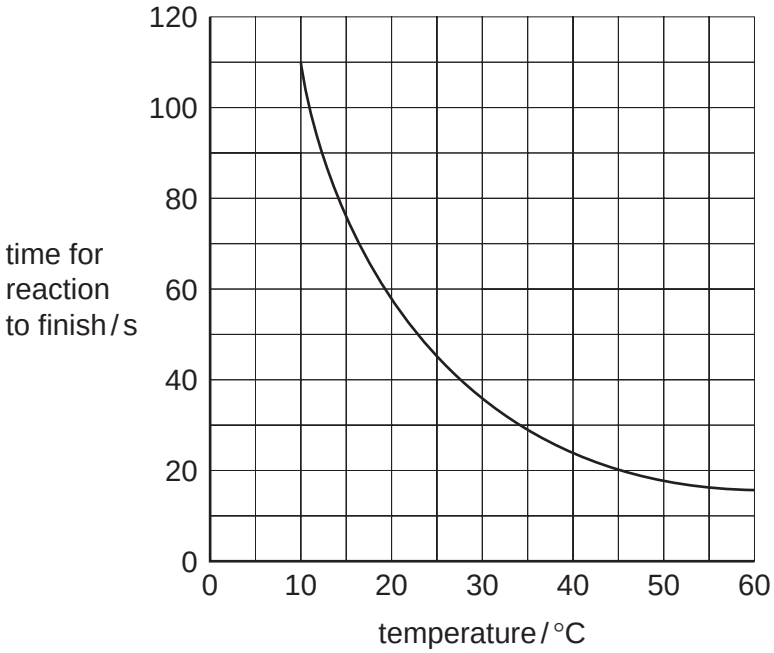

Fig. 3.1

(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]

(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]

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

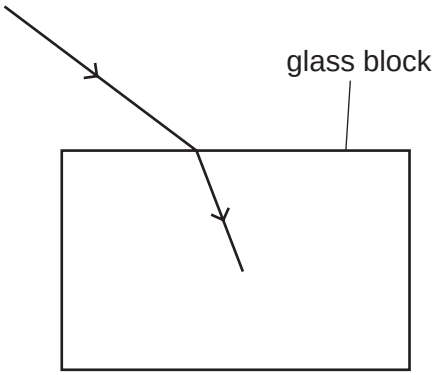

Fig. 4.1

(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]

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]

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

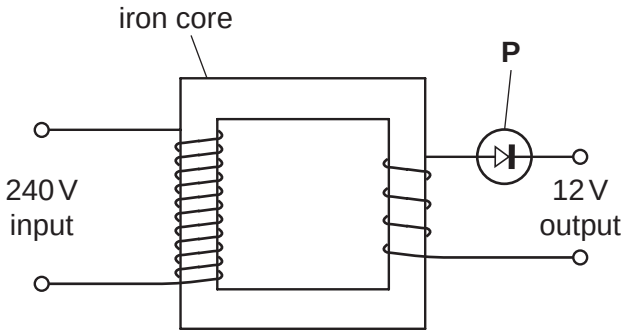

Fig. 6.1

(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]

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

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.

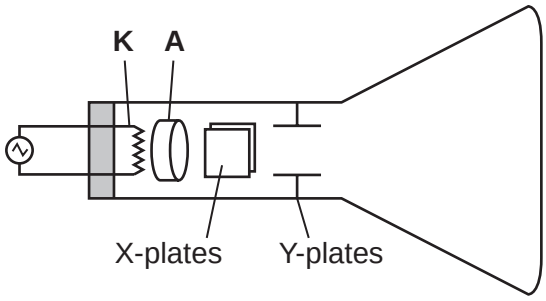

Fig. 8.1

(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.

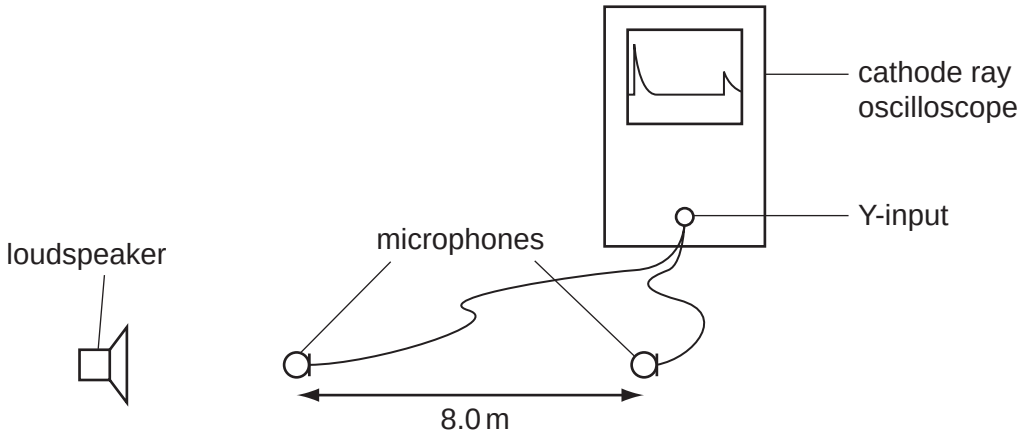

Fig. 8.2

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.

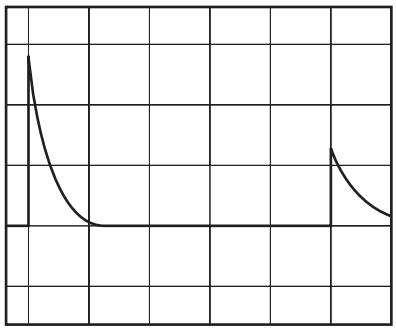

Fig. 8.3

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

time = ...

(ii) Calculate the speed of the sound.

speed = ... [3]

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]

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

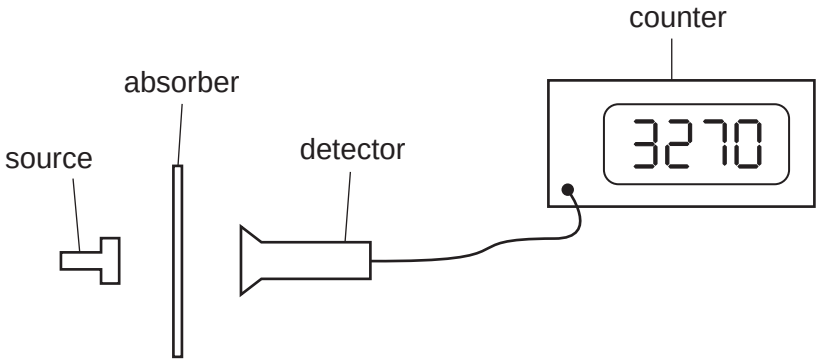

Fig. 10.1

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 †															

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: 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.).