Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0123456789

PHYSICAL SCIENCE **0652/03**

Paper 3 Theory (Core) **For Examination from 2019**

SPECIMEN PAPER

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 20.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

This document consists of **19** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

1 The owner of a factory plans to install a wind turbine to generate electricity.

(a) Describe advantages **and** disadvantages of generating electricity using a wind turbine.

advantages .....

.....

.....

disadvantages .....

.....

..... [4]

(b) State the type of installation needed to generate electricity from sunlight.

..... [1]

[Total: 5]

2 Candle wax contains hydrocarbons.

Fig. 2.1 shows a burning wax candle inside a bell jar containing air.

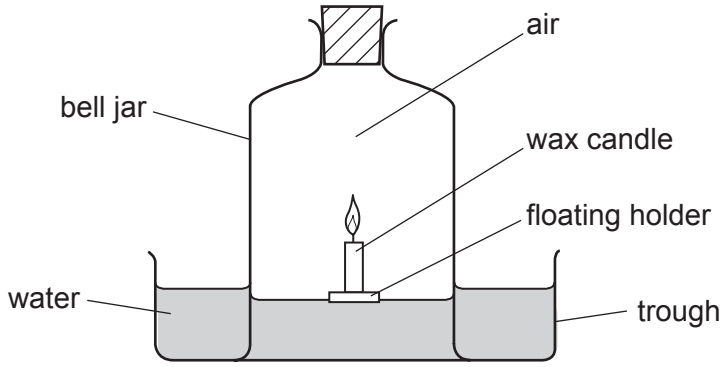


Fig. 2.1

The bell jar is placed in a trough of water.

Carbon dioxide gas is much more soluble in water than oxygen gas.

As the candle burns, the water level rises up inside the bell jar.

(a) Explain why the water level rises when the candle burns.

.....

.....

..... [2]

(b) After several minutes the candle stops burning.

Circle the name of the main gas in the bell jar after the candle stops burning.

argon **chlorine** **oxygen** **nitrogen**

[1]

(c) Explain why it can be hazardous to burn hydrocarbons in a limited supply of air.

.....

.....

..... [2]

[Total: 5]

3 Fig. 3.1 shows how the speed of an object varies during a period of 30 s.

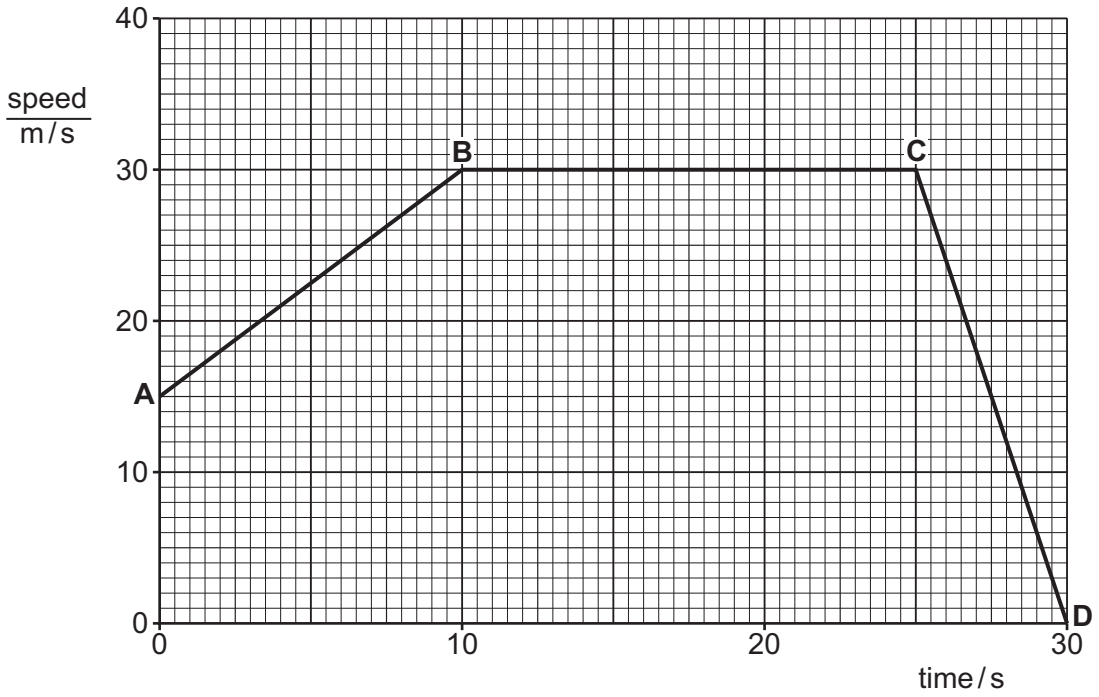


Fig. 3.1

(a) (i) State the speed of the object at point **A**.

speed = ... m/s [1]

(ii) State the speed of the object at point **D**.

speed = ... m/s [1]

(b) Describe the motion of the object between points **B** and **C**.

..... [1]

(c) Determine the distance travelled between points **C** and **D**.

distance = ... m [3]

(d) The total distance travelled by the object between points **A** and **D** is 750 m.

Calculate the average speed of the object.

State the formula you use and show your working.

average speed = ... m / s [3]

[Total: 9]

4 Carbon-12, $^{12}_{6}C$, and carbon-14, $^{14}_{6}C$, are isotopes of carbon.

Complete Table 4.1 to give the number of protons, electrons and neutrons in one atom of each isotope.

Table 4.1

isotope		protons	electrons	neutrons
carbon-12	$^{12}_{6}C$	.....	.....	.....
carbon-14	$^{14}_{6}C$	.....	.....	.....

[2]

[Total: 2]

5 A teacher demonstrates the properties of water waves using a shallow container of water.

A barrier is placed in the container.

Fig. 5.1 shows a view of the container from above.

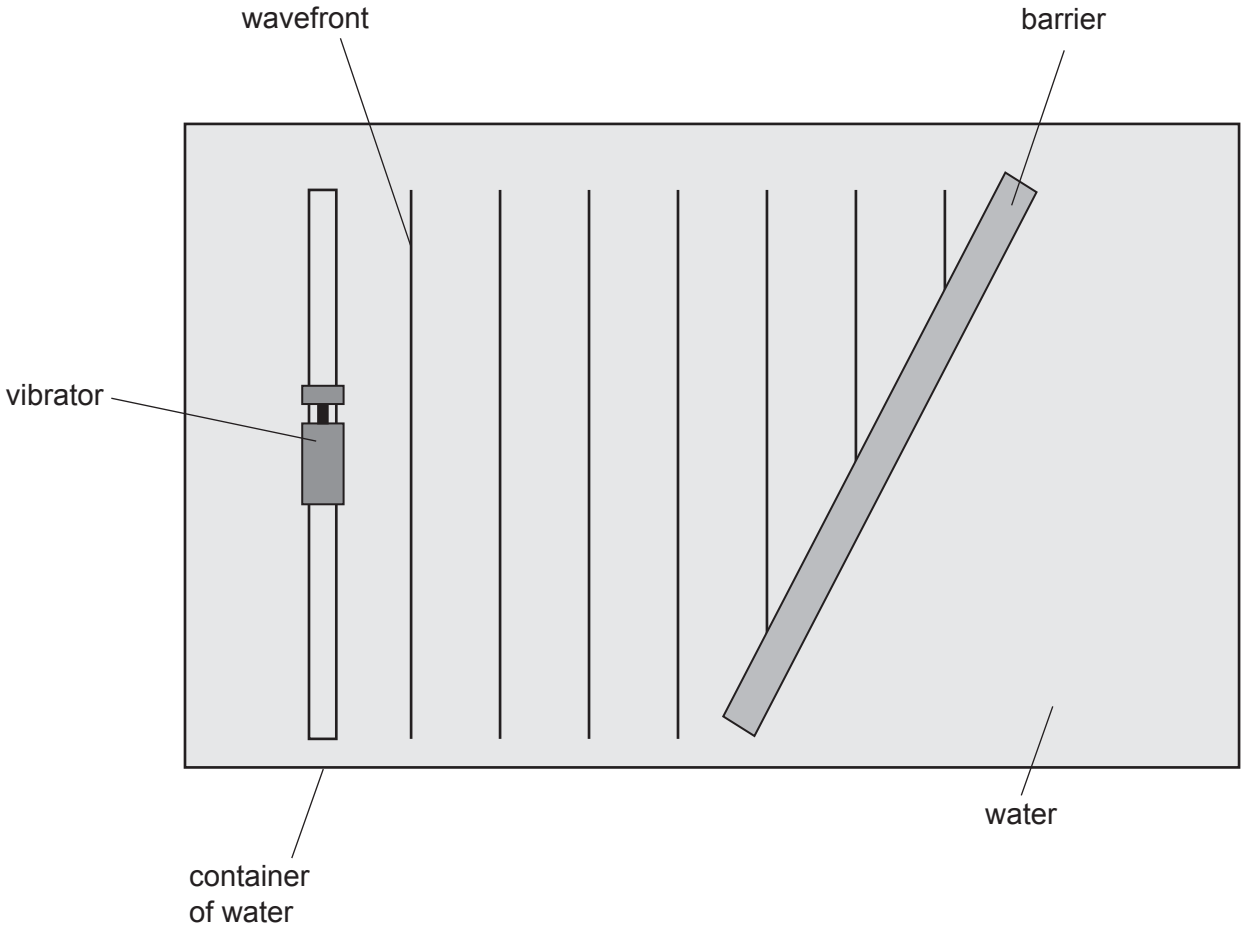


Fig. 5.1

The vibrator produces a series of waves of constant frequency. These waves move towards the barrier and do not pass over it.

(a) On Fig. 5.1, draw a double-headed arrow (↔) to show **one** wavelength. [1]

(b) (i) Name the wave property demonstrated by the waves that have hit the barrier.

..... [1]

(ii) On Fig. 5.1, draw **three** wavefronts after they hit the barrier. [3]

[Total: 5]

6 Copper(II) oxide is added to dilute sulfuric acid until there is no further reaction.

The mixture is filtered to obtain a blue solution (filtrate).

The blue solution contains copper(II) ions.

(a) A reagent is added to the blue solution to identify the copper(II) ions.

Name the reagent and describe the positive result.

reagent .....

result .....

.....

[2]

(b) **(i)** Explain how dry crystals of a blue solid can be obtained from this blue solution.

.....

.....

.....

..... [3]

(ii) Name this blue solid.

..... [1]

[Total: 6]

7 Fig. 7.1 represents the regions of the electromagnetic spectrum.

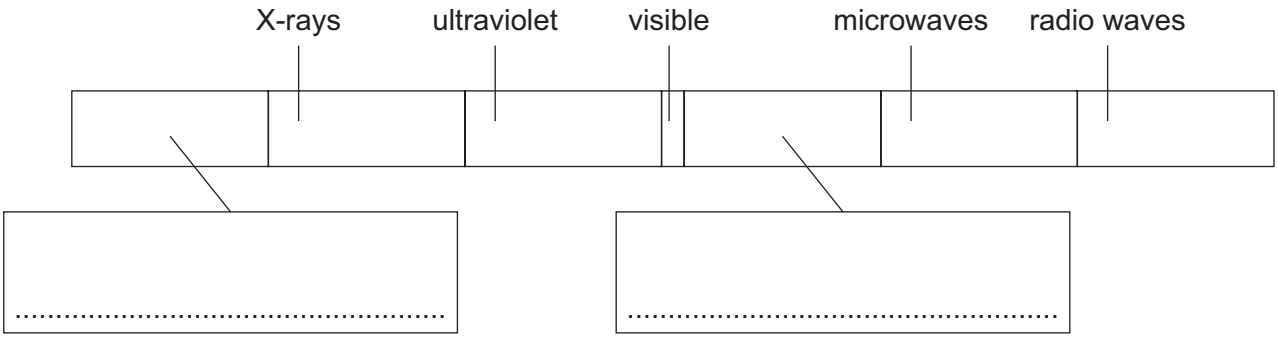


Fig. 7.1

(a) Two of the regions have not been named on Fig. 7.1.

In the two boxes in Fig. 7.1, write the names of these regions. [2]

(b) On Fig. 7.1, write the letter **S** at the short wavelength end of the electromagnetic spectrum. [1]

(c) State one use of

microwaves.....

X-rays .....
[2]

[Total: 5]

8 Sodium is in Group I of the Periodic Table.

(a) State two observations made when sodium reacts with water.

1. .....

2. .....
[2]

(b) Name one element in Group I that is more reactive than sodium and one element in Group I that is less reactive than sodium.

more reactive than sodium .....

less reactive than sodium .....
[1]

(c) Sodium is in Period 3 of the Periodic Table.

Name one metal and one non-metal in the same period as sodium.

metal .....

non-metal .....
[2]

(d) Sodium reacts with chlorine to form sodium chloride, an ionic compound.

Draw a dot-and-cross diagram to show the ions in sodium chloride.

[3]

[Total: 8]

Question 9 starts on page 12

9 **(a)** A student builds the circuit shown in Fig. 9.1.

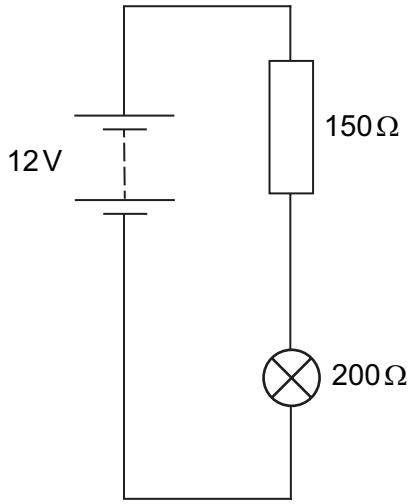


Fig. 9.1

(i) Calculate the total resistance in the circuit.

resistance = ... Ω [1]

(ii) Use your answer to **(i)** to calculate the current in the circuit.

State the formula that you use, show your working and give the unit in your answer.

current = ... unit ..... [3]

(iii) Calculate the potential difference (p.d.) across the lamp.

Show your working.

p.d. = ... V [2]

(iv) Describe how the circuit may be modified so that the brightness of the lamp can be controlled.

.....

..... [1]

(b) The student builds another circuit as shown in Fig. 9.2.

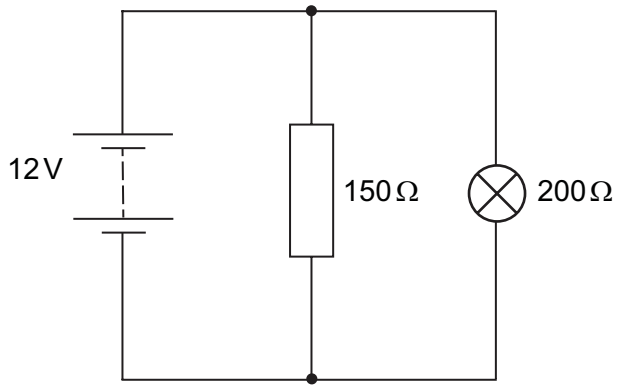


Fig. 9.2

Predict how the brightness of the lamp in this circuit compares to the lamp in Fig. 9.1.
Explain your answer.

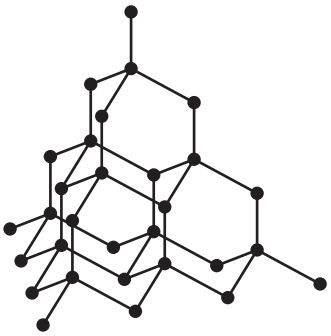
.....

.....

..... [2]

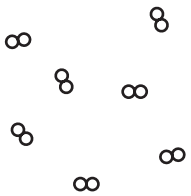
[Total: 9]

10 The structures of diamond and chlorine are shown in Fig. 10.1.



diamond

● = carbon atom



chlorine

○ = chlorine atom

Fig. 10.1

(a) Describe the structure of these two substances.

Use the list of words to help you.

covalent

diatomic

giant structure

macromolecule

molecule

diamond .....

.....

.....

.....

chlorine .....

.....

.....

.....

[4]

(b) The molecular structure of a compound containing carbon and chlorine is shown in Fig. 10.2.

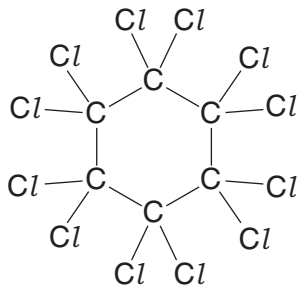


Fig. 10.2

Give the formula of this compound.

..... [1]

(c) Chlorine is a halogen.

Table 10.1 shows some properties of the halogens.

Table 10.1

element	boiling point / °C	density in liquid state / g per dm^3	colour at room temperature
fluorine	–188	1.51	yellow
chlorine	–35	1.56	.....
bromine	–7	.....	.....
iodine	+114	4.93	grey-black

(i) Complete Table 10.1 to

- give the colours of chlorine and bromine,
- predict the density of liquid bromine.

[3]

(ii) Describe the trend in boiling point of the halogens down the group.

..... [1]

(d) Chlorine reacts with a solution of potassium iodide, KI in a displacement reaction.
The products are potassium bromide and iodine, I_2

(i) Give the formula for potassium bromide.

..... [1]

(ii) Use your answer in **(i)** to complete the balanced symbol equation for this reaction.

Br_2 + KI $\rightarrow$ ..... + I_2 [1]

(iii) Suggest why bromine does **not** react with a solution of potassium chloride.

..... [1]

[Total: 12]

11 **(a)** Fig. 11.1 shows two samples of the same radioactive isotope. The samples have different mass. The substance emits β-particles during radioactive decay.

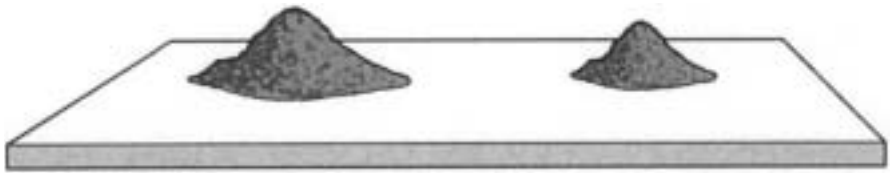


Fig 11.1

(i) Put a tick (✓) alongside **any** of the following quantities which is the same for both samples.

The half-life. ☐

The number of atoms decaying each second. ☐

The number of β-particles emitted each second. ☐

[1]

(ii) Complete the sentences below to describe the radioactive decay of this isotope.

Beta particles are emitted from the ..... of the atom.

In this process, a ..... changes into a proton.

[2]

(b) People handling radioactive materials need to take certain safety precautions.

(i) Explain why handling radioactive materials is dangerous to humans.

.....

..... [2]

(ii) State **two** safety precautions used by people handling radioactive materials.

1. .....

2. .....

[2]

[Total: 7]

12 Ethane and ethene are hydrocarbons. They each contain two carbon atoms per molecule.

(a) Complete Fig. 12.1 to show the structure of a molecule of ethane and a molecule of ethene.

Show the arrangement of all of the atoms and bonds.

C C C C

ethane ethene

Fig. 12.1 [3]

(b) Describe a chemical test to distinguish between a saturated and unsaturated hydrocarbon.

test .....

result with saturated hydrocarbon .....

.....

result with unsaturated hydrocarbon .....

.....

[3]

(c) Poly(ethene) is made from ethene.

Name the type of reaction that happens when poly(ethene) is made from ethene.

..... [1]

[Total: 7]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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