



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

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PHYSICAL SCIENCE

0652/31

Paper 3 (Core)

October/November 2018

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, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

A copy of the Periodic Table is printed on page 20.

Electronic calculators may be used.

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 **18** printed pages and **2** blank pages.

1 Fig. 1.1 shows a toy car in two positions on a ramp.

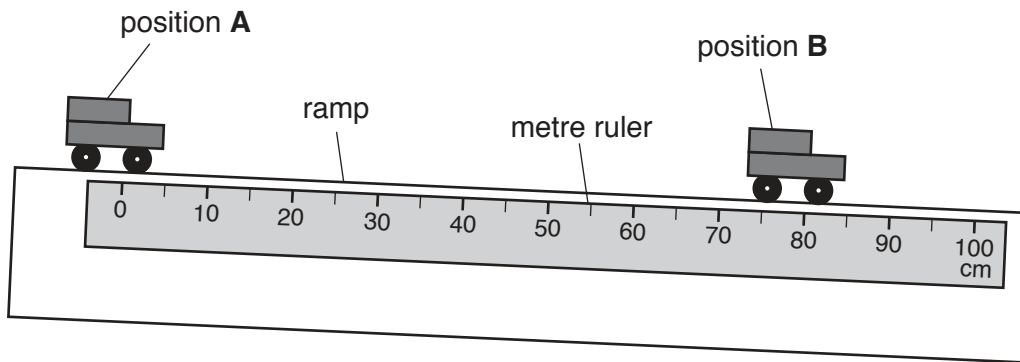


Fig. 1.1

The car is released from position **A**. It moves at a constant speed down the ramp. It takes 3.2 seconds to reach position **B**.

A metre ruler is used to measure the distance it has travelled.

(a) (i) Use Fig. 1.1 to determine the distance the car travels in moving from position **A** to position **B**.

distance = cm [2]

(ii) Calculate the speed of the car down the ramp.

speed = cm/s [2]

(b) On the axes on Fig. 1.2, sketch the speed time graph for the car as it travels down the ramp.

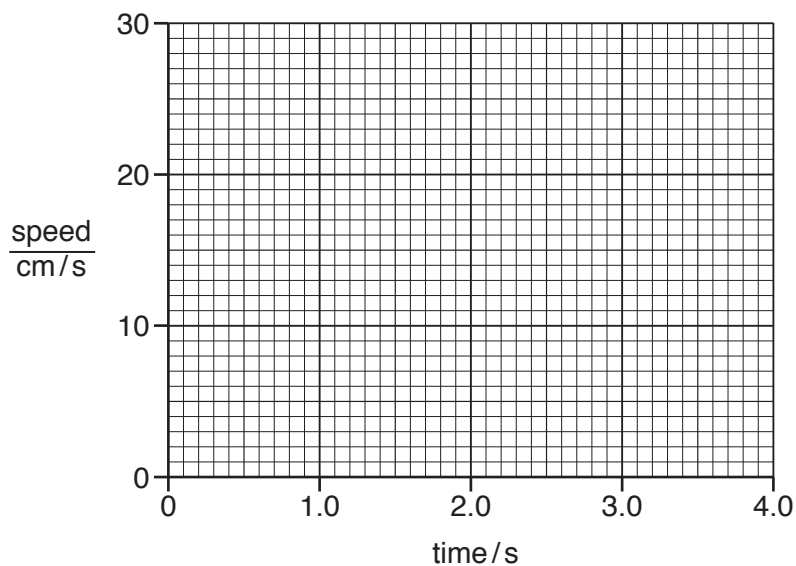


Fig. 1.2

[2]

[Total: 6]

2 The transition elements are a collection of metals in the Periodic Table.

Transition metals or their compounds are often used as catalysts.

(a) State **two** other general properties of transition elements.

1

2

[2]

(b) Some metals occur 'native' in the Earth's crust.

Name **two** transition elements which occur native.

1

2

[2]

(c) Name the transition metal alloyed with chromium to make stainless steel.

..... [1]

(d) Name the transition metal in the ore hematite.

..... [1]

[Total: 6]

3 Fig. 3.1 shows a waterfall.

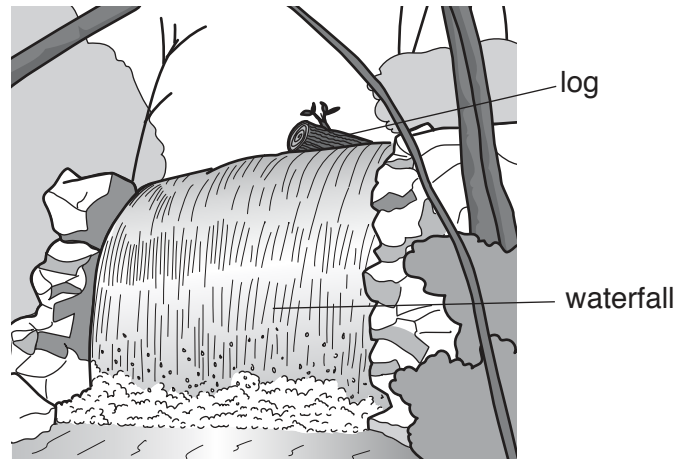


Fig. 3.1

A log at the top of the waterfall falls over the edge.

(a) (i) State the form of energy that the log has due to its position at the top of the waterfall.

..... [1]

(ii) State **two** forms of energy to which energy is transferred as the log falls.

1

2

[2]

(b) A log is caught on the bank of the river, as shown in Fig. 3.2.

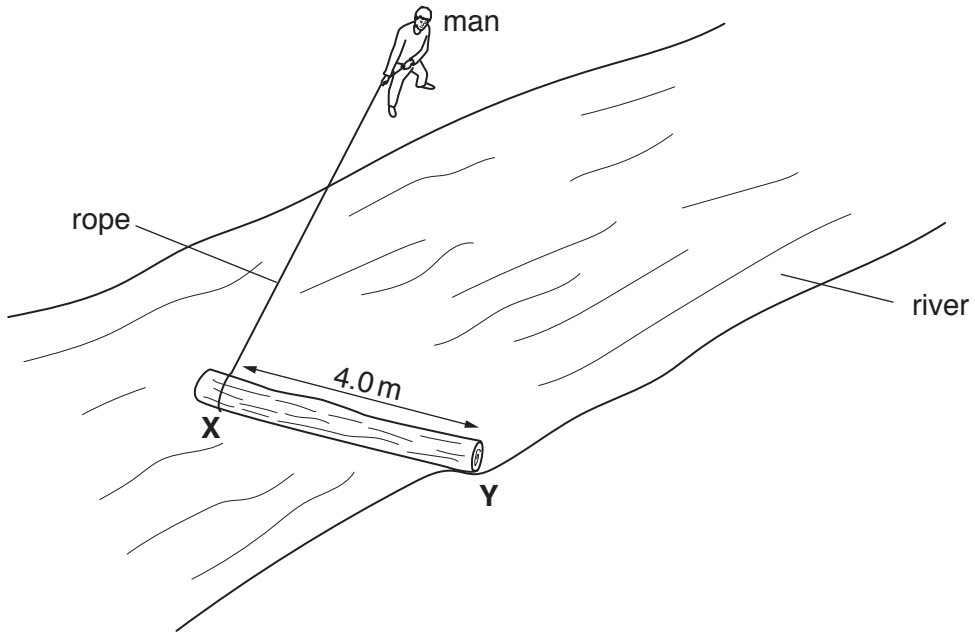


Fig. 3.2

A man attaches the rope to the log at point **X** and pulls it with a force of 350 N at right angles to the log.

Point **Y** acts as a pivot. The distance between point **X** and point **Y** is 4.0 m.

(i) Calculate the moment of the 350 N force about point **Y**.

Show your working.

moment = Nm [2]

(ii) Describe what is meant by the *moment of a force about a point*.

.....

 [1]

[Total: 6]

4 Sodium is an element in Group I of the Periodic Table.

(a) State why sodium is in Group I.

.....
 [1]

(b) The representation of sodium in the Periodic Table is shown in Fig. 4.1.

7
11 Na sodium 23
19

Fig. 4.1

State what the numbers 11 and 23 represent.

11
 23 [2]

(c) Sodium reacts with chlorine to form an ionic compound.

(i) Name this ionic compound.

..... [1]

(ii) Write a balanced chemical equation for this reaction.

..... [2]

(d) Complete Table 4.1 to give the formulae of the two ions in potassium iodide.

Table 4.1

name	formula of ion
potassium	
iodide	

[2]

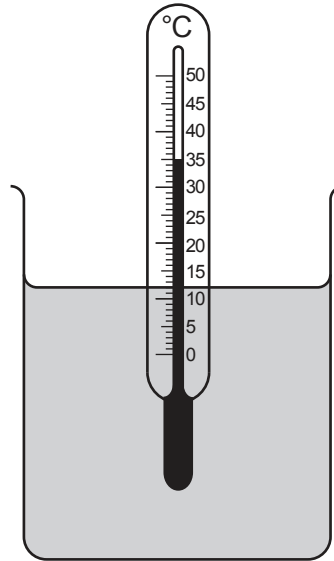
[Total: 8]

5 Fig. 5.1 and Fig. 5.2 show a liquid-in-glass thermometer at room temperature and the same thermometer in a beaker of warm water.



at room temperature

Fig. 5.1



in beaker of warm water

Fig. 5.2

(a) (i) Record the temperature of the warm water.

temperature = °C [1]

(ii) Explain why the liquid in the thermometer moves up the thermometer when the temperature rises.

.....
 [1]

(b) The Celsius scale has two fixed points.

Name one fixed point.

..... [1]

(c) Water in a beaker is boiling.

Describe what happens when water boils.

.....

 [2]

[Total: 5]

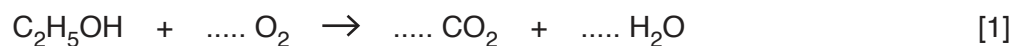
6 Ethanol can be used as a fuel.

It burns in air in an exothermic reaction.

(a) State what is meant by *exothermic*.

.....
..... [1]

(b) (i) Balance this equation for the burning of ethanol.



(ii) Name **one** product of this reaction.

.....
..... [1]

(c) Explain why it is dangerous to burn ethanol in a limited supply of air.

.....
.....
.....
..... [2]

(d) Name a fuel that does **not** produce any carbon containing compounds when it is burned.

..... [1]

[Total: 6]

7 Fig. 7.1 shows a side view of water waves in a shallow tank.

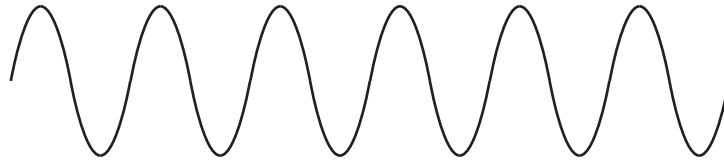


Fig. 7.1

(a) On Fig 7.1, draw an arrow to show

(i) the amplitude of the wave and label this arrow **A**, [1]

(ii) the wavelength of the wave and label this arrow λ . [1]

(b) Fig. 7.2 shows a view of the water waves from above.

The wavefronts move from deep water to an area of shallow water.

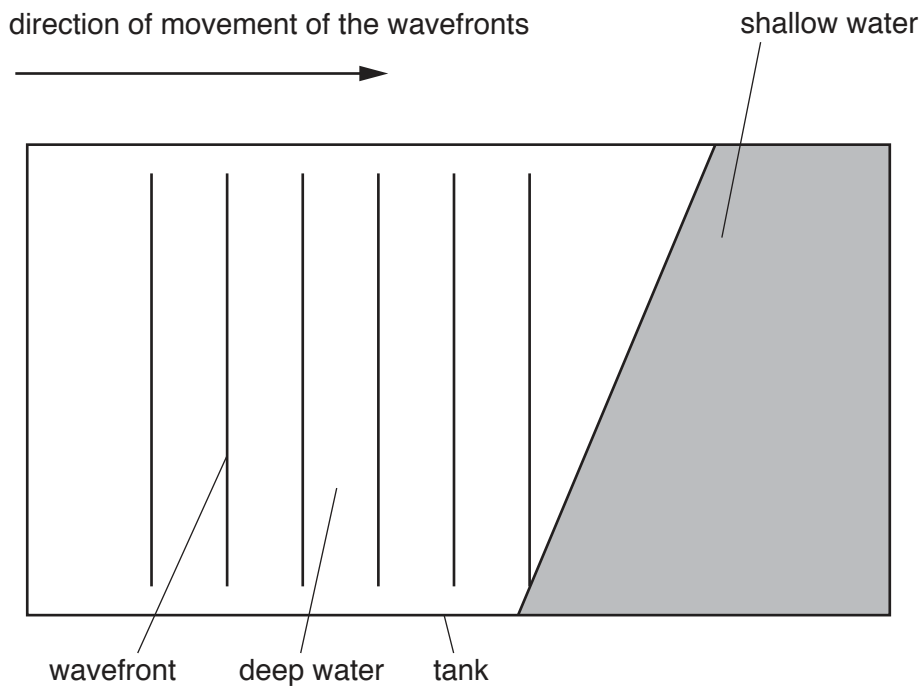


Fig. 7.2

(i) On Fig. 7.2, draw **three** more wavefronts to show what happens when the wavefronts enter the shallow water. [3]

(ii) Name the process which occurs as the wavefronts enter the shallow water.

..... [1]

[Total: 6]

- 8 The alkanes are members of a homologous series.

Table 8.1 gives the names and formulae of some alkanes.

Table 8.1

name	formula
methane	CH ₄
ethane	C ₂ H ₆
propane
butane	C ₄ H ₁₀

- (a) Complete Table 8.1 by suggesting the formula of propane.

Propane has three carbon atoms per molecule.

[1]

- (b) Calculate the relative molecular mass, M_r , of butane.

[A_r : C, 12; H, 1]

M_r [1]

- (c) (i) Ethene, C₂H₄, is an unsaturated hydrocarbon.

Draw the structures of ethene and ethane in the space below.

ethene

ethane

[2]

- (ii) Name the reagent used to show that ethene is unsaturated and that ethane is saturated.
State the observation made for each hydrocarbon with this reagent.

reagent

observation with ethene

.....

observation with ethane

..... [3]

[Total: 7]

9 Fig. 9.1 shows the electromagnetic spectrum.

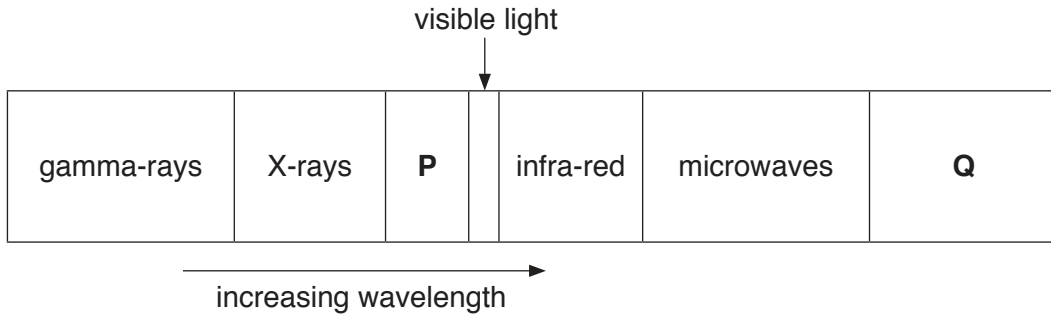


Fig. 9.1

(a) Name the type of wave found at

(i) P, [1]

(ii) Q. [1]

(b) As the wavelength of the waves increases, state what happens to the speed of the waves in a vacuum.

..... [1]

(c) Fig. 9.2 shows a cup of coffee emitting thermal radiation.

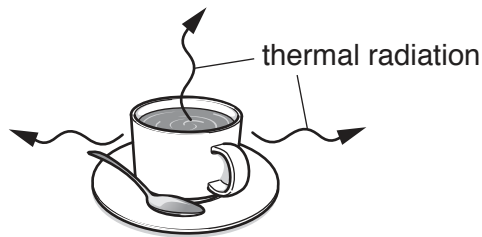


Fig. 9.2

Identify the part of the electromagnetic spectrum emitted by the cup as thermal radiation.

..... [1]

[Total: 4]

10 Fig. 10.1 shows how drinking water is obtained from river water.

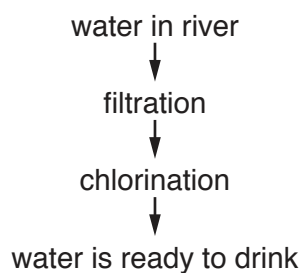


Fig. 10.1

(a) State what is removed from the river water during filtration

..... [1]

(b) (i) State what is added to the water during chlorination.

..... [1]

(ii) State how chlorination makes the water safe to drink.

..... [1]

(c) A student uses anhydrous copper(II) sulfate to test for the presence of water.

(i) Describe the colour change when she adds water to the anhydrous copper(II) sulfate.

starting colour

final colour [2]

(ii) State how anhydrous copper(II) sulfate is obtained from hydrated copper(II) sulfate for use in this test.

..... [1]

[Total: 6]

11 Fig. 11.1 is a circuit diagram.

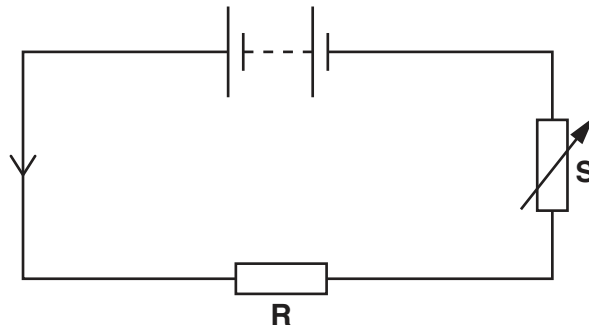


Fig. 11.1

(a) Name component **S**.

.....[1]

(b) The potential difference across resistor **R** is 4.0V.

The current in **R** is 1.6A.

(i) Determine the current in component **S**.

current = A [1]

(ii) Calculate the resistance of resistor **R**.

Show your working and state the unit.

resistance = unit [3]

(c) An identical resistor **T** is connected in parallel with resistor **R**, as shown in Fig. 11.2.

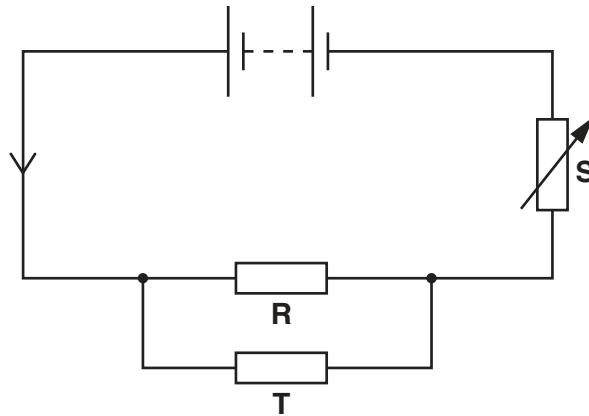


Fig. 11.2

State the effect of adding resistor **T** on the current supplied by the battery.

Explain your answer.

effect

explanation

..... [2]

[Total: 7]

- 12 (a) Aluminium saucepans do not burn when they are used to cook food but powdered aluminium explodes when it is close to a naked flame.

Explain why the aluminium behaves differently in these two situations.

.....
.....
.....
..... [2]

- (b) (i) Describe another situation where fine powders in the air are dangerously explosive.

.....
..... [1]

- (ii) Suggest a safety precaution which helps prevent explosions when working with fine powders.

.....
..... [1]

- (c) Ammonia is a chemical used in industry. It is made by reacting hydrogen gas with nitrogen gas.

- (i) Name a raw material which could be used as a source of nitrogen.

..... [1]

- (ii) The reaction to make ammonia can be very slow.

Suggest **two** ways of making the reaction faster.

1

2

[2]

[Total: 7]

13 For this question, you will be expected to use the Periodic Table on page 20.

^{131}I is an unstable isotope of iodine.

(a) (i) Determine how many protons there are in a nucleus of this isotope.

number of protons = [1]

(ii) Determine how many neutrons there are in a nucleus of this isotope.

number of neutrons = [1]

(iii) Determine how many electrons there are in a neutral atom of this isotope.

number of electrons = [1]

(b) The isotope decays by the emission of a beta-particle.

(i) State the nature of a beta-particle.

..... [1]

(ii) State how the number of protons and the number of neutrons in the nucleus changes when a beta-particle is emitted.

change to the number of protons

.....

change to the number of neutrons

.....

[2]

[Total: 6]

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The Periodic Table of Elements

Group																															
I	II	III	IV	V	VI	VII	VIII																								
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	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	Key atomic number atomic symbol name relative atomic mass		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 —																		
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 dm³ at room temperature and pressure (r.t.p.).