Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICAL SCIENCE **0652/21**

Paper 2 Multiple Choice (Extended) **October/November 2019**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

1 Carbon dioxide is a solid at temperatures below –78 °C.

What is **not** a property of solid carbon dioxide?

A It has a fixed shape.

B It is incompressible.

C Its particles are very close together.

D Its particles slide past each other.

2 Which process is used to separate the components of petroleum?

A chromatography

B crystallisation

C filtration

D fractional distillation

3 Magnesium oxide is a compound formed from a metal and a non-metal.

Which statement describes the bonding in magnesium oxide?

A Magnesium and oxygen atoms share their outer shell electrons.

B Magnesium atoms gain electrons and oxygen atoms lose electrons.

C Magnesium atoms lose electrons and oxygen atoms gain electrons.

D The magnesium atoms and oxygen atoms both gain electrons.

4 Diamond and graphite are both forms of the element carbon.

They have macromolecular structures.

Some properties are listed.

1 high melting point

2 each carbon forms four covalent bonds

3 conducts electricity

4 hard

Which of these are the properties of diamond?

A 1, 2 and 4 only **B** 1 and 4 only **C** 2 and 3 only **D** 3 and 4 only

5 Chromium(III) sulfate is made of chromium(III) ions, Cr^{3+}, and sulfate ions, SO_4^{2-}.

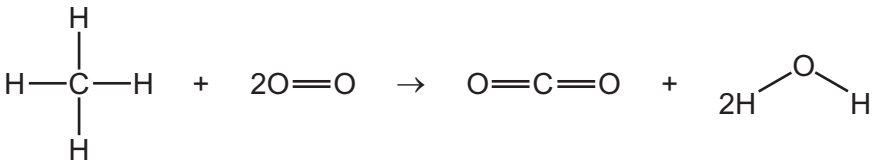
What is the formula of chromium(III) sulfate?

A $CrSO_4$ **B** $Cr_2(SO_4)_3$ **C** Cr_3SO_4 **D** $Cr_3(SO_4)_2$

6 What is the relative formula mass, M_r, of aluminium oxide Al_2O_3?

A 43 **B** 50 **C** 102 **D** 113

7 Methane reacts with oxygen to form carbon dioxide and water. Heat is given out during the reaction.



Which row identifies the number of bonds that are broken and the type of process when the bonds are broken?

	bonds broken	type of process when the bonds are broken
A	2C=O and 4O–H	endothermic
B	2C=O and 4O–H	exothermic
C	4C–H and 2O=O	endothermic
D	4C–H and 2O=O	exothermic

8 The equation for the reaction of magnesium with copper(II) oxide is shown.

$$CuO + Mg \rightarrow MgO + Cu$$

Which statement is correct?

A Copper(II) oxide is oxidised.

B Copper(II) oxide is reduced.

C Magnesium oxide is oxidised.

D Magnesium oxide is reduced.

[Turn over

9 Which row describes metallic and non-metallic oxides?

	metallic oxides	non-metallic oxides
A	acidic	basic
B	amphoteric or basic	acidic or neutral
C	amphoteric only	acidic only
D	basic only	acidic only

10 How are elements with one electron in their outer shell described?

A Group I metals

B Group I non-metals

C Group VII metals

D Group VII non-metals

11 Lithium has a lower density than sodium. Sodium is more reactive than lithium.

Which sentence predicts the properties of the Group I element, rubidium?

A It is less dense and less reactive than sodium.

B It is less dense and more reactive than sodium.

C It is more dense and less reactive than sodium.

D It is more dense and more reactive than sodium.

12 Which element is mixed with copper to make brass?

A argon

B carbon

C iodine

D zinc

13 An element, Y, reacts with aqueous copper sulfate and copper is produced.

The same element does not react with aqueous zinc sulfate.

What is the position of Y in the reactivity series?

A above zinc and above copper

B above zinc and below copper

C below zinc and above copper

D below zinc and below copper

14 Which reaction in the extraction of iron from hematite is **not** a redox reaction?

A $C + O_2 \rightarrow CO_2$

B $C + CO_2 \rightarrow 2CO$

C $CaCO_3 \rightarrow CaO + CO_2$

D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

15 Which substance is used as a chemical test for water?

A anhydrous copper(II) sulfate

B hydrated cobalt(II) chloride

C hydrated copper(II) sulfate

D pink cobalt(II) chloride

16 Which fuel does **not** produce carbon dioxide during complete combustion?

A coal

B hydrogen

C natural gas

D petroleum

17 Which statements about members of the same homologous series are correct?

1 They have the same ending to their name.

2 They have the same functional group.

3 They have the same molecular formula.

4 They have the same relative molecular mass.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

18 Which statements about the alkanes are correct?

1 They are generally unreactive except in terms of burning.

2 They burn in air to produce carbon dioxide and water.

3 They contain carbon to carbon double bonds.

4 They decolourise bromine water.

A 1, 2 and 3 only **B** 1 and 2 only **C** 1, 3 and 4 only **D** 2 and 4 only

19 When hexane is heated in the presence of a catalyst, it decomposes to give ethane, hydrogen and another hydrocarbon Y.

The equation for the reaction is shown.

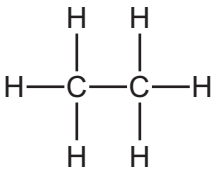
$$C_6H_{14} \rightarrow C_2H_4 + Y + H_2$$

Which type of hydrocarbon is Y and what is its formula?

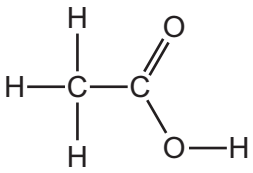
	type of hydrocarbon	formula
A	alkane	C_4H_8
B	alkane	C_4H_{10}
C	alkene	C_4H_8
D	alkene	C_4H_{10}

20 Which structure represents an unsaturated hydrocarbon?

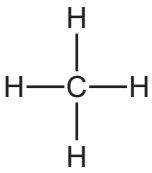
A



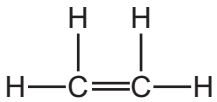
B



C



D

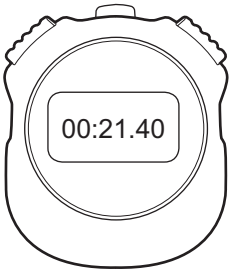


21 A student carries out an experiment to determine the period of a simple pendulum.

The student starts counting oscillations when the stopwatch reads 5.00 s and stops the stopwatch at the end of the 20th oscillation.

The diagram shows the stopwatch when the student starts counting oscillations and at the end of 20 oscillations.

stopwatch when counting starts



stopwatch at the end of 20 oscillations

What is the period of the pendulum?

A 0.25 s **B** 0.82 s **C** 1.07 s **D** 1.32 s

22 A light ball is dropped from rest from a high cliff.

Which row shows what happens after the ball is dropped and before it reaches terminal velocity?

	speed of ball	acceleration of ball
A	decreases	decreases
B	decreases	remains constant
C	increases	decreases
D	increases	remains constant

23 Three properties of a body are its mass, its shape and its size.

Which row correctly shows whether these properties can be changed by a force?

	mass	shape	size
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key

✓ = can be changed

✗ = cannot be changed

[Turn over

24 A force F acts on an object that moves in a straight line through a distance d.

The change in energy of the object is equal to $F \times d$.

Which statement **must** be correct?

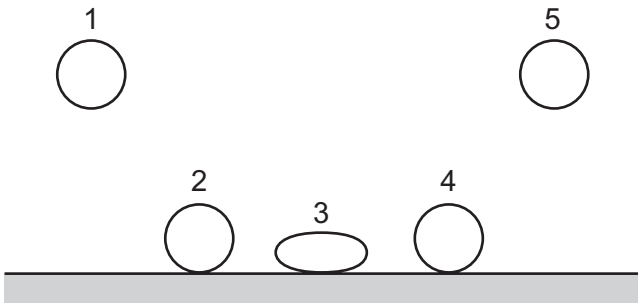
A F is in the same direction as d.

B F is perpendicular to d.

C The object gains gravitational potential energy.

D The object is moving at constant speed.

25 The diagram shows a number of stages of a soft ball bouncing.



Between which two stages does the kinetic energy transfer to elastic (strain) energy?

A 1 to 2 **B** 2 to 3 **C** 3 to 4 **D** 4 to 5

26 A ball is thrown vertically upwards with a speed of 5.00 m / s.

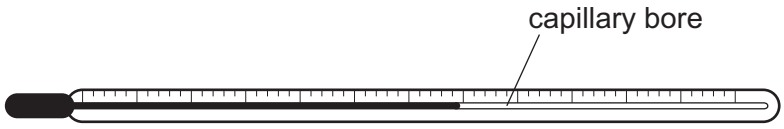
All of the ball's initial kinetic energy is transferred into gravitational potential energy.

What is the maximum height reached by the ball?

The acceleration of free fall is 10.0 m / s^2.

A 0.250 m **B** 1.25 m **C** 2.50 m **D** 12.5 m

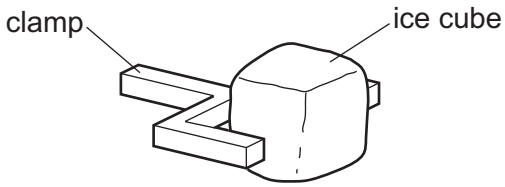
27 The internal diameter of the capillary bore of a thermometer is increased.



How does this affect the range and the sensitivity of the thermometer?

	range	sensitivity
A	increased	decreased
B	increased	increased
C	no change	decreased
D	no change	increased

28 An ice cube is held in a clamp. The air next to the ice cube becomes very cold.



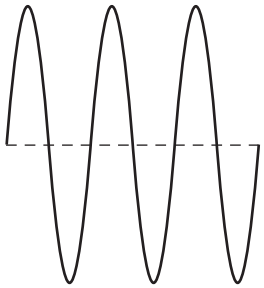
What happens to the density of the air as the air becomes colder and in which direction does the cold air move?

	density change of the air	direction the air moves
A	decreases	downwards
B	decreases	upwards
C	increases	downwards
D	increases	upwards

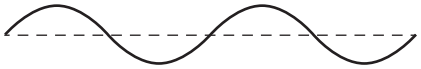
29 The diagrams represent water waves in a deep pond. The diagrams are all drawn to the same scale and the waves are all moving with the same speed.

Which diagram shows the wave with the highest frequency?

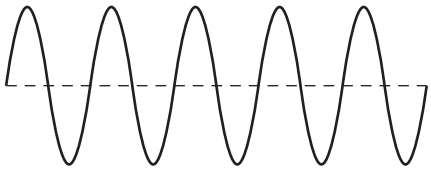
A



B



C



D

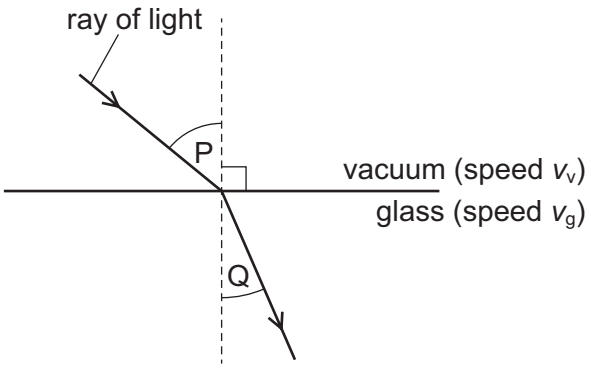
30 The speed of light in a vacuum is v_v.

The speed of light in glass is v_g.

Light passes from a vacuum into glass.

The diagram shows the change in direction of the light.

Angles P and Q are labelled.



Which row compares v_v with v_g and gives an expression for the refractive index of the glass?

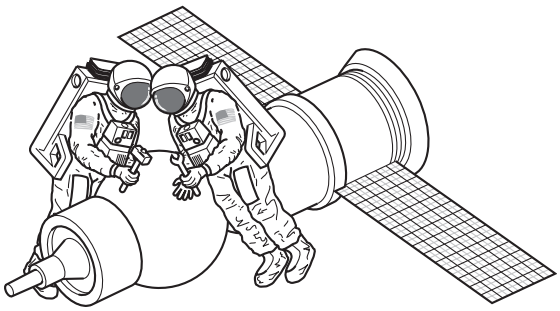
	speeds	refractive index
A	$v_v < v_g$	$\frac{\sin P}{\sin Q}$
B	$v_v < v_g$	$\frac{\sin Q}{\sin P}$
C	$v_v > v_g$	$\frac{\sin P}{\sin Q}$
D	$v_v > v_g$	$\frac{\sin Q}{\sin P}$

31 What is the approximate speed of electromagnetic waves in air?

A $3 \times 10^2\,m/s$ **B** $3 \times 10^4\,m/s$ **C** $3 \times 10^6\,m/s$ **D** $3 \times 10^8\,m/s$

[Turn over

32 Two astronauts without radios can only communicate in space if their helmets are touching. There is no air in space.



What does this show about sound?

A It can travel through a solid and a vacuum.

B It can travel through a solid but cannot travel through a vacuum.

C It cannot travel through a solid but can travel through a vacuum.

D It cannot travel through either a solid or a vacuum.

33 In 2.0 hours, a charge of 5000 C flows at a constant rate past a point in a circuit.

What is the current in the circuit?

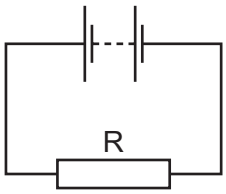
A 0.69 A **B** 42 A **C** 2500 A **D** 10 000 A

34 The current in a battery is 5.00 A. The battery supplies 2.70 kJ of energy in 1.0 minute.

What is the e.m.f. of the battery?

A 0.540 V **B** 9.00 V **C** 13.5 V **D** 32.4 V

35 A circuit contains a battery and a resistor R.



Another resistor is now added in series with R.

Which statement is correct?

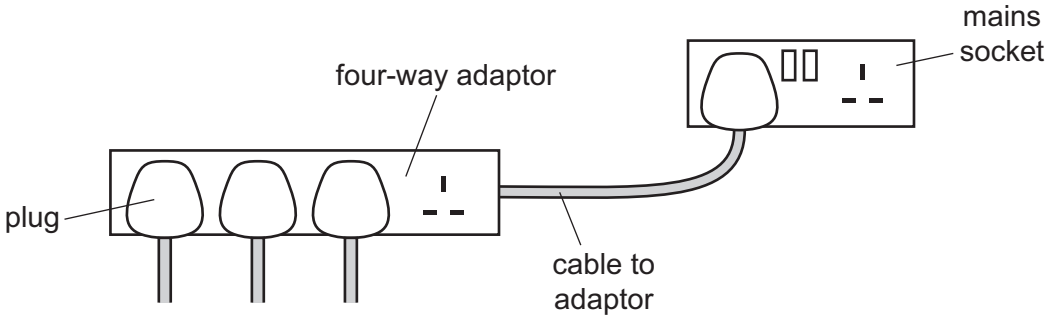
A The e.m.f. of the battery decreases.

B The e.m.f. of the battery increases.

C The p.d. across R decreases.

D The p.d. across R increases.

36 A four-way adaptor is connected by a cable to the mains supply. The cable is protected by a 13 A fuse.



Which use of the adaptor causes the fuse protecting the cable to 'blow'?

	number of plugs used	current in plugs
A	1	12 A
B	2	10 A and 10 A
C	3	3 A, 4 A and 5 A
D	4	2 A, 2 A, 3 A and 3 A

37 In a transformer, how is an e.m.f. induced across the secondary coil?

A The primary coil and the secondary coil are connected in parallel.

B The primary coil and the secondary coil are connected in series.

C The primary coil produces a changing magnetic field that links to the secondary coil.

D The primary coil produces a constant magnetic field that links to the secondary coil.

38 A current-carrying coil experiences a turning effect when it is placed in a magnetic field.

Which row gives two changes to the coil that each result in a greater turning effect?

	number of turns on the coil	current in the coil
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

[Turn over

39 Americium-241 ($^{241}_{95}Am$) decays to neptunium-237 ($^{237}_{93}Np$).

One or two particles are emitted during this decay.

Which particles are emitted?

A an α-particle only

B a β-particle only

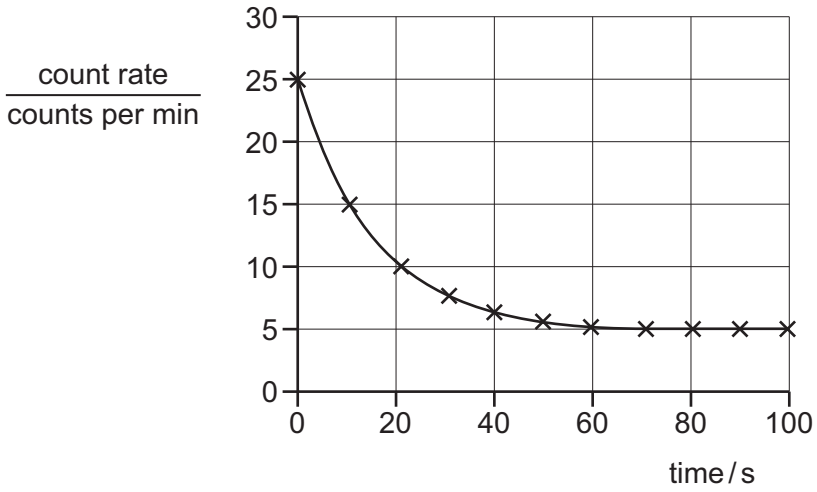
C an α-particle and a β-particle

D two β-particles

40 A teacher investigates the radiation emitted by a radioactive source.

She places a detector near the source and records how the count rate changes with time.

The results are shown on the graph.



Which row gives the count rate due to the source at the start of the experiment, and the count rate due to background radiation?

	count rate due to the source at start / counts per minute	count rate due to background radiation / counts per minute
A	20	5
B	20	20
C	25	5
D	25	20

BLANK PAGE

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.).