Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICAL SCIENCE **0652/22**

Paper 2 Multiple Choice (Extended) **October/November 2023**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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[Turn over

1 The relative molecular mass of carbon dioxide is 44.

The relative molecular mass of oxygen is 32.

Which statement about the rate of diffusion of these gases at the same temperature is correct?

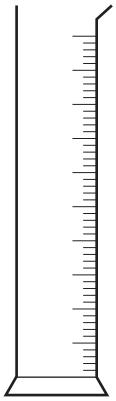
A Carbon dioxide diffuses faster because its particles move faster.

B Carbon dioxide diffuses faster because its particles move slower.

C Oxygen diffuses faster because its particles move faster.

D Oxygen diffuses faster because its particles move slower.

2 The diagram shows a piece of apparatus.



What is measured using this apparatus?

A mass

B temperature

C time

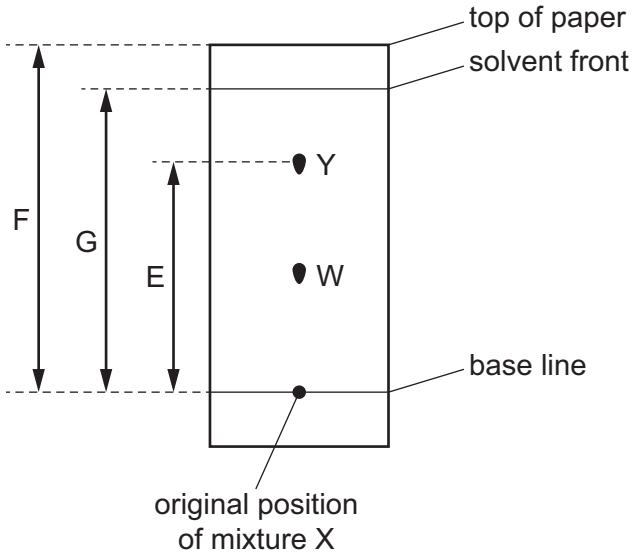
D volume

3 Mixture X is separated into its components W and Y by chromatography.

E is the distance between the base line and Y.

F is the distance between the base line and the top of the paper.

G is the distance between the base line and the solvent front.



Which equation is used to calculate the R_f value of Y?

A E ÷ F **B** E ÷ G **C** F ÷ E **D** G ÷ E

4 An isotope of sodium is represented as $^{23}_{11}Na$.

Which row represents a different isotope of sodium?

	electrons	neutrons	protons
A	11	13	11
B	12	12	12
C	13	12	13
D	23	12	23

5 The numbers of protons, neutrons and electrons in particles W, X, Y and Z are shown.

particle	number of protons	number of neutrons	number of electrons
W	17	18	17
X	17	20	17
Y	17	20	18
Z	20	20	20

Which particles have the same chemical properties?

A W, X and Y **B** W and X only **C** X, Y and Z **D** X and Y only

6 Three statements about diamond and graphite are listed.

1 They are different solid forms of the same element.

2 They each conduct electricity.

3 They have atoms that form four equally strong bonds.

Which statements are correct?

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

7 Ammonia reacts with oxygen to produce substance X and water.

An incomplete equation is shown.

$$4NH_3 + 5O_2 \rightarrow X + 6H_2O$$

What is the formula of X?

A N_2 **B** NO **C** NO_2 **D** N_2O

8 The formulae of three substances are shown.

1 NO_2

2 C_2H_5OH

3 C_3H_8

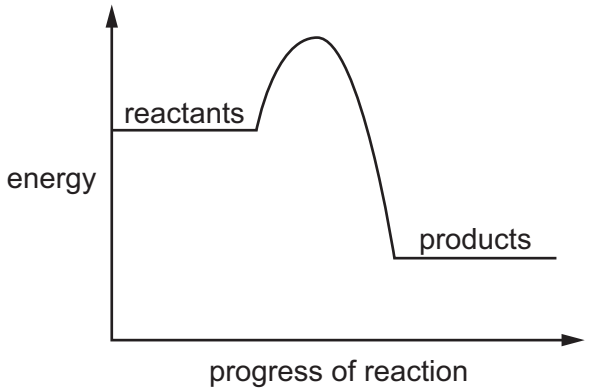
Which substances have a relative molecular mass of 46?

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

9 Which row describes what happens to the ions at each electrode during electrolysis?

	anode	cathode
A	gain of electrons	loss of electrons
B	gain of electrons	gain of electrons
C	loss of electrons	loss of electrons
D	loss of electrons	gain of electrons

10 The energy level diagram for a reaction is shown.



Which statements about the energy level diagram are correct?

1 It shows that the overall reaction is exothermic.

2 It shows that, in the reaction, more bonds are broken than formed.

3 It shows the activation energy is greater than the energy change.

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

11 The rate of reaction between marble chips and hydrochloric acid is investigated.

The equation is shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Which conditions give the fastest rate of production of carbon dioxide gas?

	concentration of hydrochloric acid	size of marble chips	hydrochloric acid temperature / °C
A	high	small	30
B	high	medium	25
C	low	large	30
D	low	small	20

12 Lead is extracted from its ore using carbon monoxide.

The equation is shown.

$$PbO + CO \rightarrow Pb + CO_2$$

Which statement explains what happens to the lead atoms and carbon atoms in the reactants?

A Lead and carbon are oxidised.

B Lead and carbon are reduced.

C Lead is oxidised and carbon is reduced.

D Lead is reduced and carbon is oxidised.

13 Hydrogen chloride reacts with water as shown.

$$HCl + H_2O \rightarrow Cl^- + H_3O^+$$

Which statement about this reaction is correct?

A Hydrogen chloride is acting as an acid because it accepts a proton.

B Hydrogen chloride is acting as a base because it accepts a proton.

C Water is acting as an acid because it accepts a proton.

D Water is acting as a base because it accepts a proton.

14 Zinc oxide reacts with both dilute nitric acid and aqueous sodium hydroxide.

Which type of oxide is zinc oxide?

A acidic

B amphoteric

C basic

D neutral

15 Elements in the Periodic Table are arranged in groups.

Which statements about the groups are correct?

1 The group number of an element is equal to the number of occupied electron shells in an atom of the element.

2 The group number of an element is equal to the number of outer shell electrons in an atom of the element.

3 An element in Group II will show greater metallic character than an element in Group VI.

4 Atoms of an element in Group VII will lose electrons more readily that atoms of an element in Group I.

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

16 Chloride ions are identified using aqueous silver nitrate.

Before aqueous silver nitrate is added, the pH of the mixture must be below 7.

Which substance is added to aqueous silver nitrate before testing for chloride ions?

A aqueous ammonia

B aqueous sodium hydroxide

C dilute hydrochloric acid

D dilute nitric acid

17 Gas X is a carbon-containing greenhouse gas which has no effect on limewater.

Which statement about gas X is correct?

A It is a gas formed during respiration.

B It is the main constituent of clean air.

C It is the main constituent of natural gas.

D It relights a glowing splint.

18 What are the products of the complete combustion of methane?

A carbon monoxide and hydrogen

B carbon dioxide, carbon monoxide and water

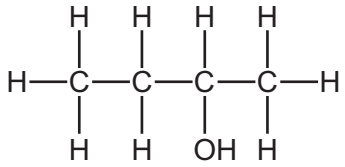
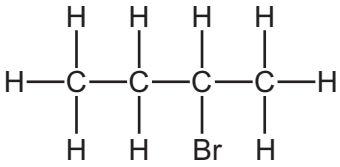
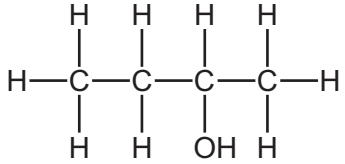
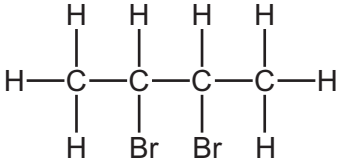
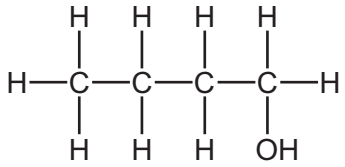
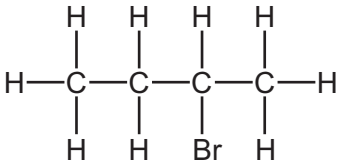
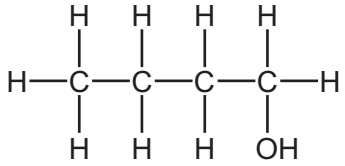
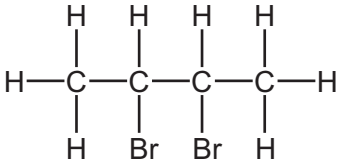
C carbon dioxide and water only

D carbon monoxide and water only

19 The formula of but-2-ene is $CH_3CH=CHCH_3$.

But-2-ene is reacted separately with steam and with bromine.

Which row identifies the structures of the products of these reactions?

	with steam	with bromine
A		
B		
C		
D		

20 Liquid X has the properties shown.

- It is colourless.
- It is flammable.
- It can be made by the reaction of ethene with steam.
- The complete combustion of X produces carbon dioxide and water.

What is X?

A ethanol

B methane

C petrol

D poly(ethene)

21 Which quantity is measured using a micrometer screw gauge?

A the diameter of a thin wire

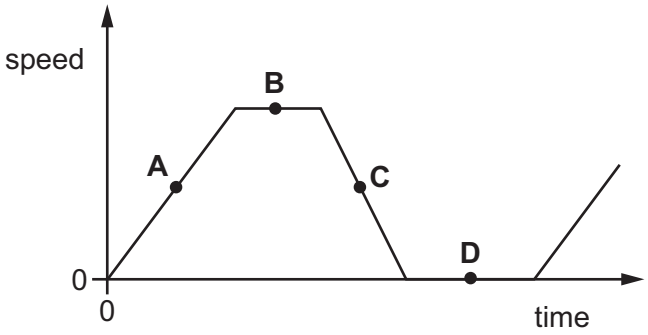
B the mass of an atom

C the small current in a circuit

D the wavelength of a light wave

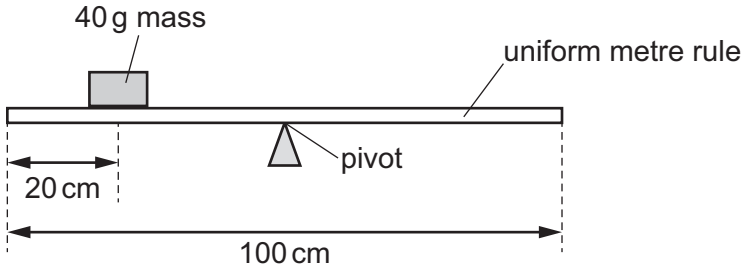
22 The diagram shows a speed–time graph for a bus.

At which labelled point is the bus moving with constant speed?



23 A pivot is placed under the 50 cm mark of a uniform metre rule.

A 40 g mass is placed at the 20 cm mark.



A 50 g mass is placed on the rule to balance it.

Where is the 50 g mass placed?

A at the 16 cm mark on the rule

B at the 24 cm mark on the rule

C at the 66 cm mark on the rule

D at the 74 cm mark on the rule

24 A solid cube of mass 50 kg rests on a horizontal surface.

The length of each side of the cube is 50 cm.

The gravitational field strength is 10 N / kg.

What is the pressure on the horizontal surface due to the cube?

A 200 Pa **B** 400 Pa **C** 2000 Pa **D** 4000 Pa

25 A student wishes to calculate his useful power output as he runs up some stairs.

He measures the time he takes to run up the stairs.

He can determine his power output if he knows only **one** other quantity.

Which quantity does he need to know?

A his final velocity

B his increase in potential energy

C his mass

D his weight

26 Which energy source is a store of gravitational potential energy?

A coal

B geothermal

C hydroelectric

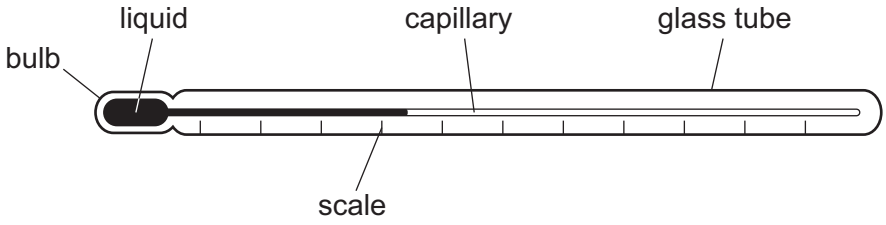
D nuclear

27 A solid, a liquid and a gas all have the same volume. They are all heated through the same temperature increase and they all expand.

Which state of matter expands the least and which state of matter expands the most?

	expands the least	expands the most
A	gas	solid
B	liquid	gas
C	solid	gas
D	solid	liquid

28 The diagram shows a liquid-in-glass thermometer.



Which single change to the design of the thermometer increases the sensitivity?

A decreasing the diameter of the capillary

B decreasing the mass of the liquid in the bulb

C increasing the length of the glass tube

D increasing the number of divisions on the scale

29 How is heat transferred through a vacuum?

A by conduction only

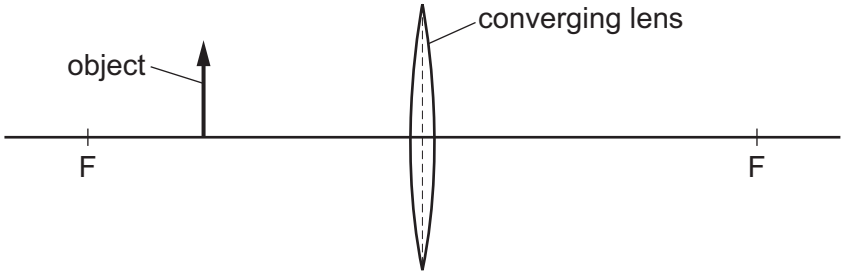
B by convection only

C by radiation only

D by conduction and radiation

30 The diagram shows an object in front of a converging lens. Each of the two points marked F is a principal focus (focal point) of the lens.

The lens forms an image of the object.



How is the image described?

	size of image	nature of image
A	diminished	real
B	diminished	virtual
C	enlarged	real
D	enlarged	virtual

31 Light from the Sun takes 8.3 minutes to reach the Earth through the vacuum of space.

What is the distance between the Sun and the Earth?

A 6.0×10^5 m **B** 3.6×10^7 m **C** 2.5×10^9 m **D** 1.5×10^{11} m

32 What is the nature of a sound wave and in which direction do the particles vibrate in this type of wave?

	nature of sound wave	direction of vibration of particles
A	longitudinal	particles vibrate at right angles to the direction of the wave
B	longitudinal	particles vibrate parallel to the direction of the wave
C	transverse	particles vibrate at right angles to the direction of the wave
D	transverse	particles vibrate parallel to the direction of the wave

33 A vibrating object produces waves of different frequencies in air.

Which frequency is that of a sound wave that a human with normal hearing can hear?

A 2.5 Hz **B** 1000 Hz **C** 25 000 Hz **D** 100 000 Hz

34 Which metal is used to make the core of an electromagnet and what is a property of an electromagnet?

	metal used for core	property of electromagnet
A	soft iron	it can be switched on and off
B	soft iron	it is a permanent magnet
C	steel	it can be switched on and off
D	steel	it is a permanent magnet

35 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

36 A lamp is in a circuit that is protected by a 1 A fuse. The lamp is switched on and it lights normally.

The 1 A fuse is now replaced with a 5 A fuse.

What happens when the lamp is switched on?

A The lamp lights normally.

B The fuse blows so the lamp does not light.

C The lamp lights less brightly.

D The lamp lights more brightly.

37 What is the purpose of the split-ring commutator in a d.c. motor?

A to prevent the current in the coil from becoming too large

B to reverse the current in the coil every half-turn

C to reverse the poles of the magnet every turn

D to step up the potential difference across the coil

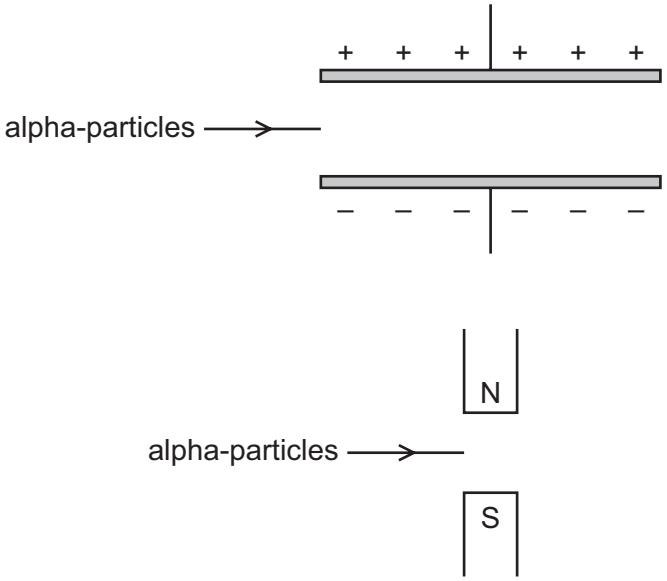
38 One isotope of iodine can be written as $^{131}_{53}\mathrm{I}$.

Which row describes a different isotope of iodine?

	atomic number	mass number
A	52	131
B	52	132
C	53	131
D	53	132

39 The first diagram shows a beam of alpha-particles entering an electric field.

The second diagram shows a beam of alpha-particles entering a magnetic field.



In which direction is the beam deflected in each of the fields?

	electric field	magnetic field
A	towards the negative plate	into the page
B	towards the negative plate	out of the page
C	towards the positive plate	into the page
D	towards the positive plate	out of the page

40 The background count recorded by a detector in a laboratory is 40 counts per minute.

When a radioactive source is brought close to the detector, the count rate becomes 840 counts per minute.

The half-life of the source is 3.0 minutes.

What is the count rate recorded by the detector 9.0 minutes later?

A 40 counts / minute

B 100 counts / minute

C 105 counts / minute

D 140 counts / minute

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).