Cambridge Assessment International Education

Cambridge IGCSE™

CO-ORDINATED SCIENCES **0654/22**

Paper 2 Multiple Choice (Extended) **February/March 2024**

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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1 Which characteristic of living things is shown when a green plant absorbs light energy and produces glucose?

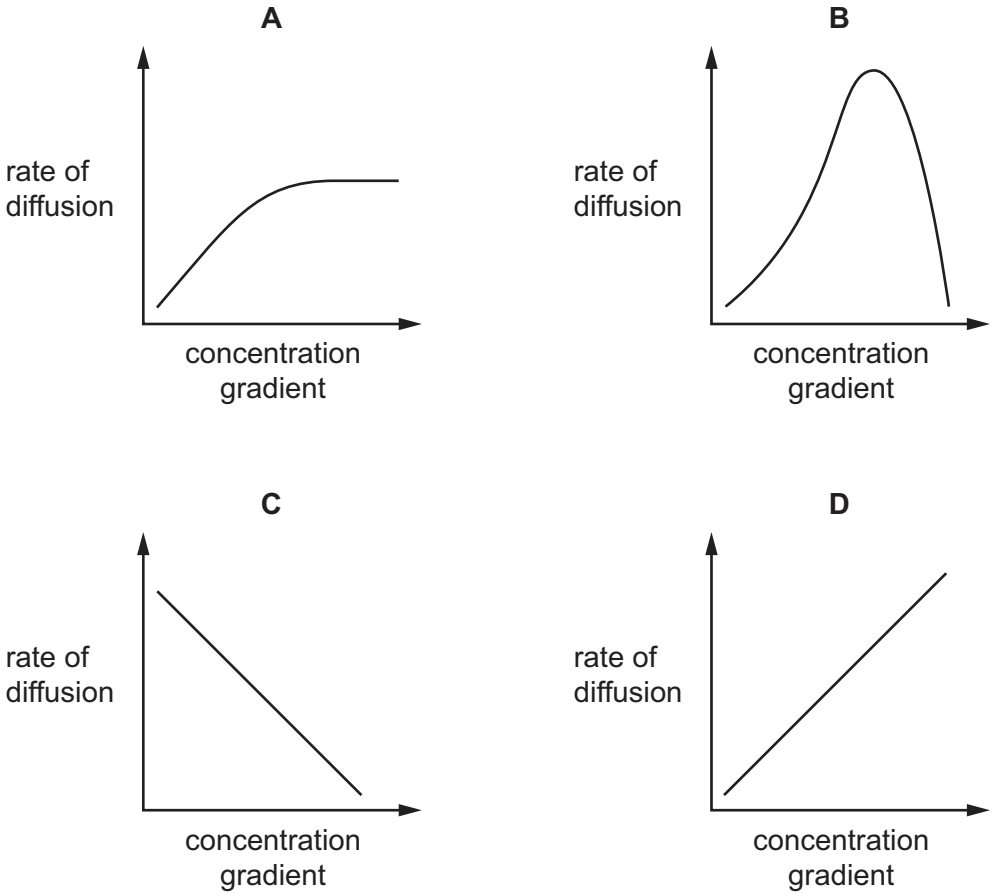
A excretion

B growth

C nutrition

D respiration

2 What is the effect of increasing the concentration gradient on the rate of diffusion?



3 Which row identifies the elements that are found in a protein molecule?

	carbon	hydrogen	nitrogen	oxygen
A	✓	✗	✓	✓
B	✓	✓	✗	✓
C	✓	✓	✓	✓
D	✗	✓	✓	✓

4 Which statements explain why an enzyme stops working when heated to high temperatures?

1 There is a low frequency of collisions between substrate and enzyme.

2 The active site no longer has a complementary shape to the substrate.

3 The enzyme is denatured.

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

5 A farmer notices that the older leaves of his maize plant are becoming yellow between the veins.

What is the plant lacking?

A carbon dioxide

B magnesium ions

C sunlight

D water

6 Which statements are correct?

1 A lack of vitamin C causes scurvy.

2 A lack of vitamin D causes softening of bones.

3 A lack of calcium causes kwashiorkor.

4 A lack of iron causes marasmus.

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

7 Which statement is correct?

A Xylem vessels are living and are involved in translocation.

B Xylem vessels are living and are involved in transpiration.

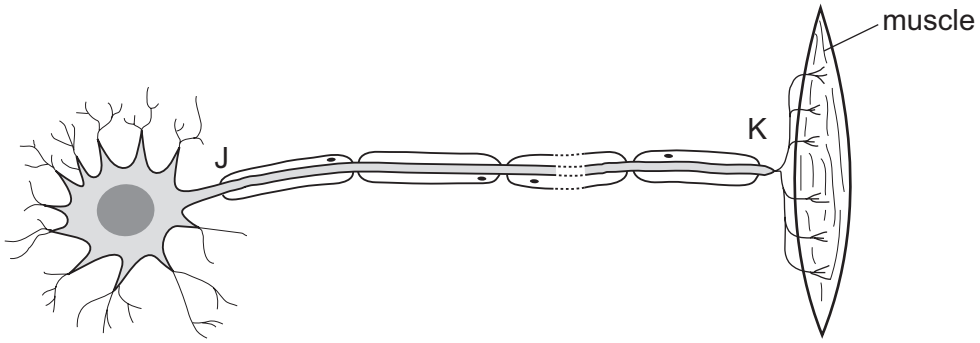
C Xylem vessels are dead and are involved in translocation.

D Xylem vessels are dead and are involved in transpiration.

8 Which substances are used and produced in aerobic respiration?

	carbon dioxide	oxygen	glucose	water
A	produced	used	produced	used
B	produced	used	used	produced
C	used	produced	produced	used
D	used	produced	used	produced

9 The diagram shows a neurone and associated structures.



Which type of neurone is shown and in which direction do impulses travel?

	type of neurone	direction of impulse
A	motor	J to K
B	motor	K to J
C	sensory	J to K
D	sensory	K to J

10 The body cells of tigers have 38 chromosomes.

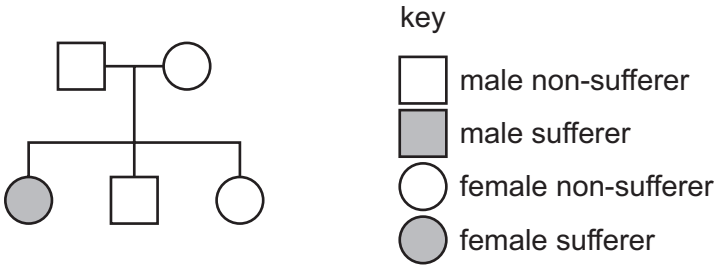
Which row shows the numbers of chromosomes involved during sexual reproduction in tigers?

	egg cell	sperm cell	zygote	offspring body cell
A	38	38	19	38
B	19	19	38	76
C	19	19	38	38
D	38	38	76	76

11 Cystic fibrosis is a genetic condition.

The allele for cystic fibrosis is recessive.

The diagram shows inheritance of cystic fibrosis in a family.



What is the chance of the next child having cystic fibrosis?

A 0% **B** 25% **C** 75% **D** 100%

12 Which type of organism obtains energy by feeding only on plants?

A herbivore

B carnivore

C producer

D secondary consumer

13 Deforestation changes the concentration of carbon dioxide and oxygen in the atmosphere.

Which statement is correct?

A There is less carbon dioxide and more oxygen because there are fewer trees photosynthesising.

B There is less carbon dioxide and less oxygen because there are fewer trees respiring.

C There is more carbon dioxide and less oxygen because there are fewer trees photosynthesising.

D There is more carbon dioxide and more oxygen because there are fewer trees respiring.

14 Which changes are chemical changes?

1 iron rusting

2 burning coal

3 dissolving sugar in water

4 boiling water

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

15 Which row identifies the types of elements that form covalent compounds and a physical property of covalent compounds?

	types of elements	physical property
A	metals and non-metals	high volatility
B	metals and non-metals	low volatility
C	non-metals only	high volatility
D	non-metals only	low volatility

16 In an experiment, 2.4 g of magnesium, Mg, is burned in 5.0 g of oxygen, O_2.

The equation for the reaction is shown.

$$2Mg + O_2 \rightarrow 2MgO$$

Which row identifies the substance that reacts completely and shows the mass of magnesium oxide formed?

	substance that reacts completely	mass of magnesium oxide formed / g
A	magnesium	4.0
B	magnesium	7.4
C	oxygen	4.0
D	oxygen	7.4

17 Aqueous copper(II) sulfate is electrolysed using carbon electrodes.

Which row describes this electrolysis?

	gas bubbles are seen at the anode	oxygen is produced at the negative electrode	copper ions are reduced
A	no	no	no
B	yes	yes	yes
C	yes	no	yes
D	no	yes	no

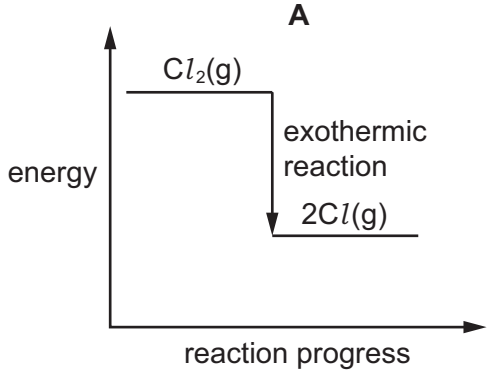
18 Ultraviolet light causes a chlorine molecule to break down to form two chlorine atoms.

The equation for the reaction is shown.

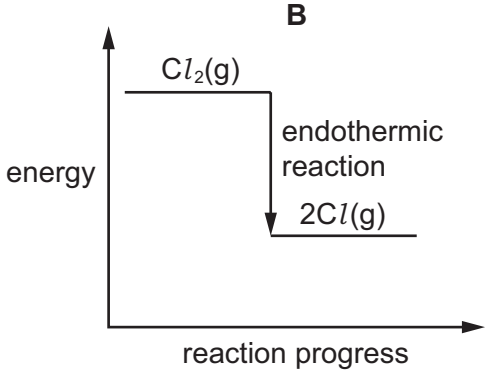
$$Cl_2(g) \rightarrow 2Cl(g)$$

What is the energy level diagram for this reaction?

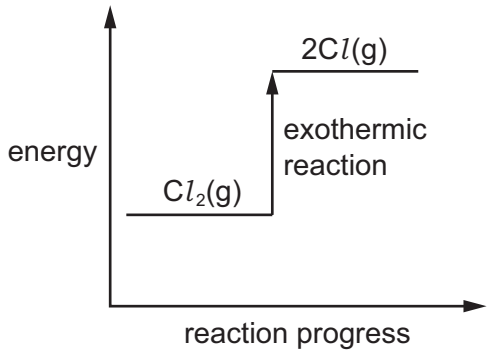
A



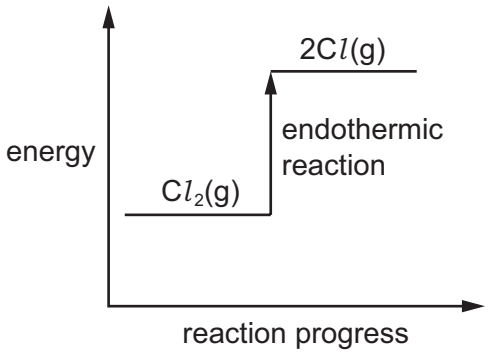
B



C



D



19 A reaction is carried out at two different temperatures.

Which statement about the reaction at the higher temperature is **not** correct?

A A greater proportion of reacting particles possess the activation energy.

B Reacting particles collide more frequently.

C Reacting particles have greater kinetic energy.

D The activation energy of the reaction decreases.

[Turn over

20 The equation for the reaction between sodium bromide and concentrated sulfuric acid is shown.

$$2NaBr + 2H_2SO_4 \rightarrow Na_2SO_4 + Br_2 + SO_2 + 2H_2O$$

What is oxidised in this reaction?

A sodium ions

B bromide ions

C hydrogen ions

D sulfate ions

21 What is used to test for ammonia gas?

A a lighted splint

B aqueous sodium hydroxide

C damp red litmus paper

D limewater

22 Which description of the Group I elements is correct?

A relatively hard metals

B relatively soft metals

C low melting point non-metals

D unreactive gases

23 Element E is a transition element. It reacts with oxygen to form an oxide with the formula EO.

A student suggests three properties for element E and its oxide.

1 Element E floats on water.

2 The oxide EO is a white solid.

3 The oxide EO is basic and reacts with dilute acid.

Which of the suggestions must be correct?

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

24 Elements Q, T, X and Z are metals.

The equations for three reactions between some of these metals and some oxides and chlorides of these metals are shown.

$$Q(s) + XO(s) \rightarrow QO(s) + X(s)$$

$$T(s) + ZCl_2(aq) \rightarrow TCl_2(aq) + Z(s)$$

$$X(s) + TCl_2(aq) \rightarrow XCl_2(aq) + T(s)$$

Which metal has the greatest tendency to form positive ions?

A Q **B** T **C** X **D** Z

25 Which row explains the use of chlorination and filtration in the treatment of the water supply?

	chlorination	filtration
A	to neutralise acids	to remove dissolved substances
B	to neutralise bases	to remove insoluble substances
C	to kill bacteria	to remove dissolved substances
D	to kill bacteria	to remove insoluble substances

26 The Contact process is used to manufacture sulfuric acid.

Which step in the Contact process is reversible?

A sulfur reacting with oxygen

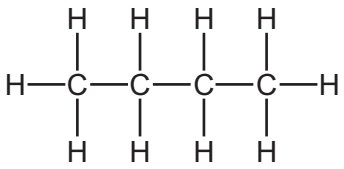
B sulfur dioxide reacting with oxygen

C sulfuric acid reacting with sulfur trioxide

D oleum, $H_2S_2O_7$, reacting with water

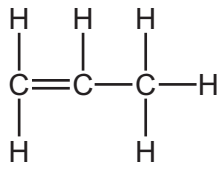
27 Which compound name matches the structure shown?

A



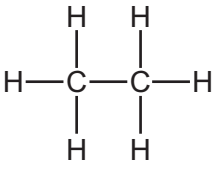
propane

B



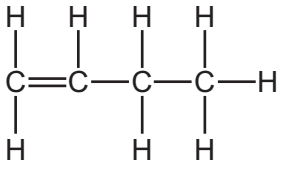
propene

C



methane

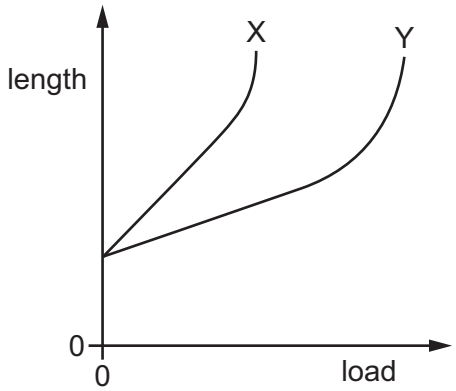
D



butane

28 X and Y are two springs.

The graph shows how the lengths of X and Y vary with the loads suspended from them.



Which statement about X and Y is correct?

A Neither spring obeys Hooke's law for any value of load.

B The unstretched lengths of X and Y are different.

C The spring constant of X is greater than the spring constant of Y.

D Y needs a greater load than X to reach its limit of proportionality.

29 A 900 W oven operates for 2.0 minutes.

How much energy is transferred by the oven?

A 7.5 J **B** 450 J **C** 1.8 kJ **D** 108 kJ

30 Which list of energy sources contains only **non-renewable** sources?

A coal, gas, nuclear fission

B coal, gas, geothermal

C gas, geothermal, nuclear fission

D gas, solar, wind

31 The more energetic molecules of a liquid are escaping from its surface, causing the liquid to cool.

What is happening to the liquid?

A It is boiling.

B It is condensing.

C It is evaporating.

D It is melting.

32 When solids, liquids and gases are heated, they expand.

What is the order of the expansions of solids, liquids and gases, from smallest to largest?

A gas → liquid → solid

B liquid → gas → solid

C solid → gas → liquid

D solid → liquid → gas

33 An object is placed in front of a mirror on a wall.

Which statement about the image formed by the mirror is correct?

A The image and the object are equal distances from the mirror.

B The image is diminished (smaller than the object).

C The image is enlarged (larger than the object).

D The image is inverted (upside down).

34 What is the definition of the refractive index *n* of a substance?

A $\dfrac{\text{speed of light in a vacuum}}{\text{speed of light in the substance}}$

B $\dfrac{\text{speed of light in the substance}}{\text{speed of light in a vacuum}}$

C $\dfrac{\text{frequency of light in a vacuum}}{\text{frequency of light in the substance}}$

D $\dfrac{\text{frequency of light in the substance}}{\text{frequency of light in a vacuum}}$

35 The electromagnetic spectrum includes radio waves, infrared waves and X-rays.

What is the correct sequence of these waves in order of increasing wavelength (smallest wavelength first)?

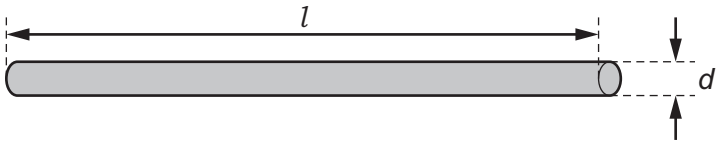
A infrared waves, radio waves, X-rays

B infrared waves, X-rays, radio waves

C X-rays, infrared waves, radio waves

D X-rays, radio waves, infrared waves

36 The diagram shows a wire of length l and diameter *d*.



Which pair of changes **must** increase the resistance of the wire?

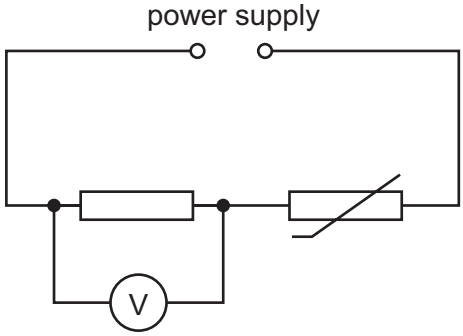
A decreasing l and decreasing *d*

B decreasing l and increasing *d*

C increasing l and decreasing *d*

D increasing l and increasing *d*

37 The circuit shows a resistor and an NTC thermistor connected in series with a power supply. A voltmeter is connected across the resistor.



The temperature of the thermistor increases.

What happens to the resistance of the thermistor and what happens to the reading on the voltmeter?

	resistance of thermistor	reading on voltmeter
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

38 The table shows the usual current in each of four household appliances and the fuse used to protect each of them.

The only fuses available are rated at 3 A, 5 A or 13 A.

Which row shows an appliance that has been fitted with the most appropriate of the fuses available?

	appliance	current / A	fuse rating / A
A	hairdryer	5.5	5
B	kettle	7.5	13
C	lawnmower	5.0	3
D	slow cooker	1.0	5

39 A magnet is moved in and out of a coil and an electromotive force (e.m.f.) is induced.

How can the size of the induced e.m.f. be decreased?

A Add more turns to the coil.

B Move the magnet more quickly.

C Move the magnet more slowly.

D Turn the magnet around before moving it in and out.

40 A nucleus of carbon $^{14}_{6}C$ decays by beta (β^-)-emission to an isotope of nitrogen N.

What is the nuclide of nitrogen formed?

A $^{10}_{4}N$ **B** $^{14}_{5}N$ **C** $^{14}_{7}N$ **D** $^{15}_{7}N$

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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.).