



## **Cambridge International Examinations**

Cambridge International General Certificate of Secondary Education

CHEMISTRY 0620/23

Paper 2 Multiple Choice (Extended) October/November 2016

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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.



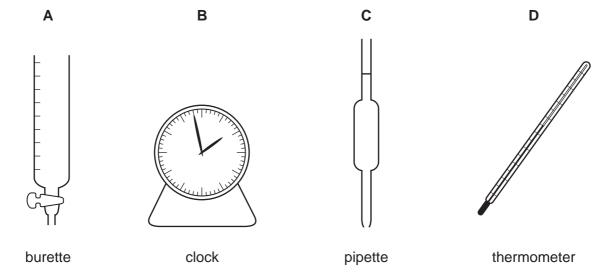
1 'Particles moving **very slowly** from an area of higher concentration to an area of lower concentration.'

Which process is being described?

- A a liquid being frozen
- B a solid melting
- C a substance diffusing through a liquid
- **D** a substance diffusing through the air
- **2** A student mixes 25 cm<sup>3</sup> samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

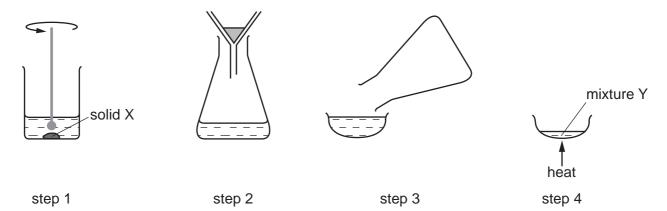
In each case, the student measures the change in temperature to test if the reaction is exothermic.

Which piece of apparatus is **not** needed?



**3** A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.



In **step 5**, how is a pure sample of solid X obtained from mixture Y?

- A dissolving
- **B** distillation
- C evaporating
- **D** filtering
- 4 An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

	protons	neutrons
Α	13	14
В	13	27
С	14	13
D	21	24

**5** Ethanol is a liquid at room temperature and boils at 78 °C.

Sodium chloride is a solid at room temperature.

Which statement about the bonding in ethanol and sodium chloride is **not** correct?

- A Each ethanol molecule is held together by weak covalent bonds.
- **B** The ethanol molecules are held together by weak attractive forces.
- **C** The sodium ions and chloride ions are held together by strong attractive forces.
- **D** The sodium ions and chloride ions are held together in a giant lattice.

**6** The molecules N<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, CO<sub>2</sub> and CH<sub>3</sub>OH all have covalent bonds.

These bonds consist of shared pairs of electrons.

Which row gives the total number of shared pairs of electrons in the molecules shown?

	molecule	total number of shared pairs of electrons
Α	$N_2$	2
В	$C_2H_4$	6
С	CO <sub>2</sub>	2
D	CH₃OH	4

7 Metals are malleable.

Which statement explains why metals are malleable?

- A Metallic bonding is very strong.
- **B** Metals are good conductors of electricity.
- **C** Positive metal ions are arranged in a regular lattice structure.
- **D** The layers of positive metal ions can slide over each other.
- **8** The equation shows the complete combustion of propane.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(I)$$

Which statement is correct?

- **A** 10 cm<sup>3</sup> of propane cannot burn if less than 50 cm<sup>3</sup> of oxygen is present.
- **B** 10 cm<sup>3</sup> of propane would produce 40 cm<sup>3</sup> of liquid water.
- **C** 100 cm<sup>3</sup> of oxygen would be sufficient to react completely with 20 cm<sup>3</sup> of propane.
- **D** This reaction would result in an increase in the volume of gas.
- **9** Sodium hydroxide reacts with sulfuric acid.

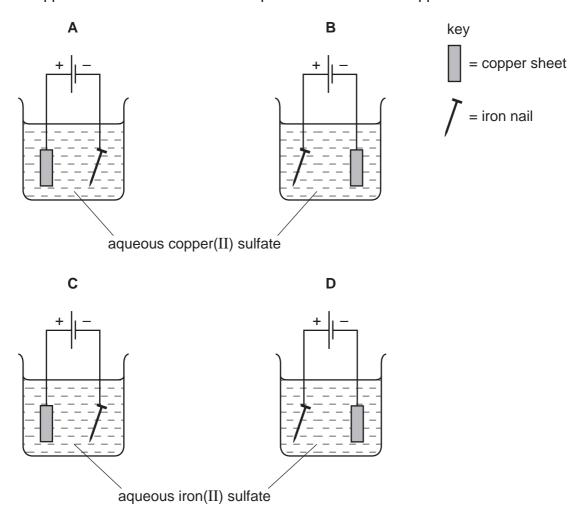
The equation for the reaction is shown.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

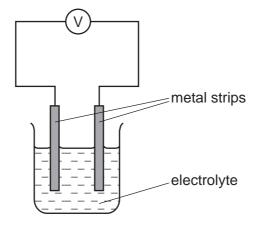
Which volume of 0.4 mol/dm³ sodium hydroxide reacts with 50.0 cm³ of 0.1 mol/dm³ sulfuric acid?

**A**  $12.5 \,\mathrm{cm}^3$  **B**  $25.0 \,\mathrm{cm}^3$  **C**  $50.0 \,\mathrm{cm}^3$  **D**  $100.0 \,\mathrm{cm}^3$ 

10 Which apparatus could be used to electroplate an iron nail with copper?



11 The diagram shows two different metal strips dipped into an electrolyte.



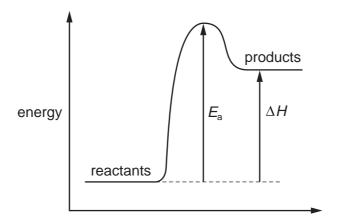
Which pair of metals produces the highest voltage?

- A copper and iron
- **B** copper and magnesium
- C copper and zinc
- **D** magnesium and iron

12 10 g of ammonium nitrate are added to water at 25 °C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10 °C.

Which word describes this change?

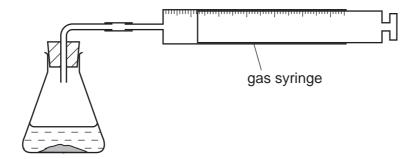
- **A** endothermic
- **B** exothermic
- **C** neutralisation
- **D** reduction
- **13** The energy level diagram for a reaction is shown.



## Which row is correct?

	sign of ∆ <i>H</i>	overall energy change	sign of E <sub>a</sub>
Α	_	exothermic	_
В	+	endothermic	+
С	+	endothermic	_
D	+	exothermic	+

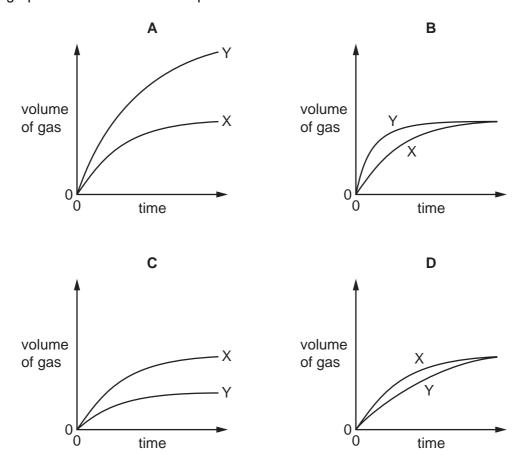
**14** An experiment X is carried out between a solid and a solution using the apparatus shown.



The volume of gas given off is measured at different times and the results plotted on a graph.

In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?



- 15 Which change in conditions increases the energy of the particles in a reaction?
  - A addition of a catalyst
  - B increase in concentration
  - C increase in surface area
  - **D** increase in temperature

16 Chlorine can be manufactured by the following reaction. The reaction is exothermic.

$$4HCl(g) + O_2(g) \rightleftharpoons 2H_2O(g) + 2Cl_2(g)$$

Which change increases the yield of chlorine at equilibrium?

- **A** adding more HCl(g)
- **B** adding more H<sub>2</sub>O(g)
- C decreasing the pressure
- **D** increasing the temperature
- 17 Which change represents an oxidation reaction?
  - A chlorine changes to chlorate(I) ions
  - B chlorine changes to chloride ions
  - **C** copper(II) ions change to copper
  - **D** potassium manganate(VII) ions change to potassium manganate(VI) ions
- 18 Germanium oxide is a white powder.

Germanium oxide reacts with concentrated hydrochloric acid.

Germanium oxide reacts with concentrated aqueous sodium hydroxide.

Germanium oxide does not dissolve when added to water.

Which type of oxide is germanium oxide?

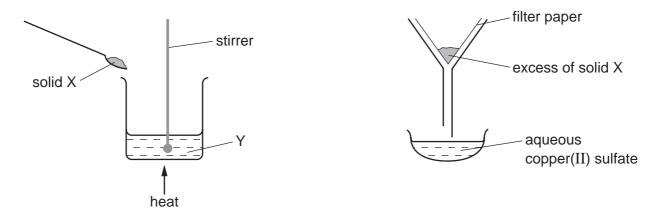
- A acidic
- **B** amphoteric
- C basic
- **D** neutral
- **19** Hydrogen chloride gas reacts with water to produce an acidic solution. The equation for the reaction is shown.

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

Which statement describes what happens during the reaction?

- A The chloride ion is formed by accepting an electron from the water.
- **B** The hydrogen chloride loses an electron to form the chloride ion.
- **C** The water accepts a proton from the hydrogen chloride.
- **D** The water donates a proton to the hydrogen chloride.

20 The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

	Х	Υ
Α	copper	aqueous iron(II) sulfate
В	copper(II) chloride	sulfuric acid
С	copper(II) oxide	sulfuric acid
D	sulfur	aqueous copper(II) chloride

21 Information about some silver compounds is shown in the table.

compound	formula	solubility in water
silver carbonate	Ag₂CO₃	insoluble
silver chloride	AgC1	insoluble
silver nitrate	AgNO <sub>3</sub>	soluble
silver oxide	Ag <sub>2</sub> O	insoluble

Which equation shows a reaction which cannot be used to make a silver salt?

**A** AgNO<sub>3</sub>(aq) + HC
$$l$$
(aq)  $\rightarrow$  AgC $l$ (s) + HNO<sub>3</sub>(aq)

**B** 
$$Ag_2O(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l)$$

**C** 
$$Ag_2CO_3(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l) + CO_2(g)$$

**D** 
$$2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$$

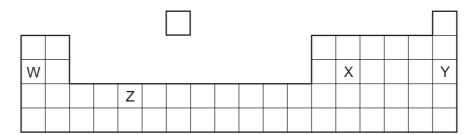
- 22 What is **not** a property of Group I metals?
  - A They are soft and can be cut with a knife.
  - **B** They react when exposed to oxygen in the air.
  - **C** They produce an acidic solution when they react with water.
  - **D** They react rapidly with water producing hydrogen gas.
- 23 Compound T is added to dilute hydrochloric acid and warmed gently.

The mixture gives off a gas which turns acidified aqueous potassium manganate(VII) from purple to colourless.

A flame test on compound T gives a lilac flame.

What is compound T?

- A sodium sulfate
- B sodium sulfite
- C potassium sulfate
- **D** potassium sulfite
- 24 Part of the Periodic Table is shown.



Which row correctly describes the properties of elements W, X, Y and Z?

	has variable oxidation states	reacts with cold water	very unreactive	has four outer shell electrons
Α	W	Υ	Z	X
В	×	W	Y	Z
С	Z	W	Y	X
D	Z	Υ	X	W

25	Basic oxides and	oxygen are	e used to	convert	iron into	steel.
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Which statement is **not** correct?

- A Carbon is converted into carbon dioxide.
- **B** Silicon is converted into silicon(IV) oxide.
- **C** The basic oxides react with acidic impurities to form slag.
- **D** The oxygen reacts with the iron to produce hematite.
- **26** The results of two experiments are given.
  - 1 Cobalt displaces manganese from an aqueous solution of a manganese salt.
  - 2 Manganese displaces silver from an aqueous solution of a silver salt.

Three more experiments are carried out.

- 3 Cobalt is added to an aqueous solution of a silver salt.
- 4 Manganese is added to an aqueous solution of a cobalt salt.
- 5 Silver is added to an aqueous solution of a cobalt salt.

In which experiments does a reaction take place?

- **A** 3 only
- **B** 3 and 4
- **C** 4 and 5
- **D** 5 only
- 27 Cryolite,  $Na_3AlF_6$ , is added to aluminium oxide in the electrolytic extraction of aluminium.

What is the reason for this?

- A to decrease the melting point of the electrolyte
- B to protect the anodes
- C to produce more aluminium
- **D** to stop the aluminium reacting with air
- 28 Different forms of steel contain different proportions of carbon.

Steel P contains a high proportion of carbon.

Steel Q contains a low proportion of carbon.

Which statement is correct?

- **A** P is stronger and more brittle than Q.
- **B** P is stronger and less brittle than Q.
- **C** P is less strong and more brittle than Q.
- **D** P is less strong and less brittle than Q.

**PMT** 

29 Air is a mixture of gases.

Which gas is present in the largest amount?

- A argon
- **B** carbon dioxide
- C nitrogen
- **D** oxygen
- 30 Which information about carbon dioxide and methane is correct?

		carbon dioxide	methane	
Α	formed when vegetation decomposes	✓	X	key
В	greenhouse gas	✓	✓	✓ = true
С	present in unpolluted air	×	×	x = false
D	produced during respiration	x	✓	

**31** A metal, X, is used to make oil pipelines.

X corrodes in air and water.

X can be protected from corrosion by attaching blocks of element Y.

Which statement is correct?

- **A** This process is known as galvanising.
- **B** Y forms positive ions more readily than X.
- **C** Y is an unreactive metal.
- **D** Y is an unreactive non-metal.
- 32 The Haber process for the manufacture of ammonia occurs at 450 °C and 250 atmospheres. The nitrogen and hydrogen are supplied in a 1:3 ratio by volume. The reaction is exothermic.

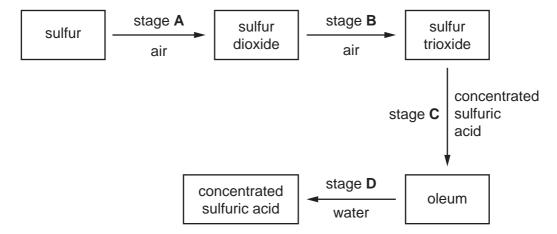
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
  $\Delta H = -92 \text{ kJ/mol}$ 

Which change causes an increase in the yield of ammonia?

- A decreasing the concentration of nitrogen
- B decreasing the pressure
- **C** decreasing the temperature
- **D** using equal amounts of the two reactants

33 The following scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



34 Slaked lime is used to neutralise an acidic soil.

How does the pH of the soil change?

	from	to
Α	6	7
В	7	8
С	8	7
D	8	6

- 35 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?
  - **A** bitumen  $\rightarrow$  diesel oil  $\rightarrow$  fuel oil  $\rightarrow$  lubricating oil
  - **B** diesel oil  $\rightarrow$  gasoline  $\rightarrow$  naphtha  $\rightarrow$  kerosene
  - **C** gasoline  $\rightarrow$  naphtha  $\rightarrow$  kerosene  $\rightarrow$  diesel oil
  - $\textbf{D} \quad \text{kerosene} \rightarrow \text{lubricating oil} \rightarrow \text{naphtha} \rightarrow \text{refinery gas}$

36 Butane reacts as shown.

What is this type of reaction?

- **A** combustion
- **B** cracking
- **C** polymerisation
- **D** reduction
- **37** Substance Z has the following characteristics.
  - 1 It burns in an excess of oxygen to form carbon dioxide and water.
  - 2 It is oxidised by air to form a liquid smelling of vinegar.
  - 3 It reacts with carboxylic acids to form esters.

What is substance Z?

- A ethane
- **B** ethanoic acid
- **C** ethanol
- **D** ethyl ethanoate
- **38** Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.

Which row shows an advantage and a disadvantage of using the catalytic addition of steam to ethene compared to fermentation?

	advantage	disadvantage
Α	fast	the product is impure
В	fast	uses non-renewable materials
С	the product is pure	slow
D	uses renewable materials	slow

39 The organic compound shown can be polymerised.

Which diagram represents a section of the polymer?

A

В

C

D

**40** The partial structure of a polymer is shown.

Which type of polymer is represented?

- A a carbohydrate
- B a polyamide
- C a polyester
- D an addition polymer

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The Periodic Table of Elements

		2	He	nelium 4	. 01	Ne	neon 20	18	Ā	argon 40	36	궃	rrypton 84	54	Xe	xenon 131	98	Rn	radon -			
					60		fluor 1§	1,	<u> </u>	chlor 35	38	<u> </u>	brond 8(	5	_	iodine 127	86	⋖	astar			
	<b> </b>				80	0	oxygen 16	16	ഗ	sulfur 32	34	Se	selenium 79	52	<u>e</u>	tellurium 128	84	Ро	polonium	116	^	livermorium -
	>				7	z	nitrogen 14	15	۵	phosphorus 31	33	As	arsenic 75	51	Sp	antimony 122	83	Ξ	bismuth 209			
	<u>\</u>				9	O	carbon 12	14	S	silicon 28	32	Ge	germanium 73	50	Sn	tin 119	82	Ъ	lead 207	114	lΉ	flerovium
	≡				2	В	boron 11	13	Αl	aluminium 27	31	Ga	gallium 70	49	드	indium 115	81	1L	thallium 204			
											30	Zn	zinc 65	48	Sq	cadmium 112	80	Hg	mercury 201	112	S	copernicium
											29	Cu	copper 64	47	Ag	silver 108	79	Αu	gold 197	111	Rg	roentgenium
dno											28	Z	nickel 59	46	Pd	palladium 106	78	Ŧ	platinum 195	110	Ds	darmstadtium -
Group											27	ပိ	cobalt 59	45	R	rhodium 103	77	<u>-</u>	indium 192	109	₩	meitnerium -
		-	I	hydrogen 1	-						26	Fe	iron 56	44	Ru	ruthenium 101	92	SO	osmium 190	108	Hs	hassium
					_						25	Mn	manganese 55	43	ည	technetium -	75	Re	rhenium 186	107	Bh	bohrium
						loc	SS				24	ပ်	chromium 52	42	Mo	molybdenum 96	74	>	tungsten 184	106	Sg	seaborgium
				Kev	atomic number	atomic symbo	name relative atomic mass				23	>	vanadium 51	41	Q N	niobium 93	73	<u>Б</u>	tantalum 181	105	Op	dubnium
					g	atol	relat				22	F	titanium 48	40	Zr	zirconium 91	72	士	hafnium 178	104	¥	rutherfordium -
											21	လွ	scandium 45	39	>	yttrium 89	57-71	lanthanoids		89–103	actinoids	
	=				4	Be	beryllium 9	12	Mg	magnesium 24	20	Ca	calcium 40	38	Š	strontium 88	56	Ва	barium 137	88	Ra	radium
	_				က	<u></u>	lithi um 7	+	Na	sodium 23	19	¥	potassium 39	37	Rb	rubidium 85	55	S	caesium 133	87	Ē	francium

28	29		61	62	63	64	65	99	29	89	69	70	71
PΝ	PΝ	P	L	Sm	Вu	Вd	٩ ط	Ò	운	ш	E	Υp	2
۵	neodymium p	prom	romethium	samarium 150	europium 152	gadolinium 157	terbium 159	dysprosium 163	holmium 165	erbium 167	thulium 169	ytterbium 173	lutetium 175
92	92		93	94	92	96	26	86	66	100	101	102	103
$\supset$	$\supset$	_	þ	Pn	Am	CB	Ř	ర	Es	Fm	Md	8 N	ت
uranium	uranium	nepi	unium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
238	238		ı	ı	ı	ı	ı	ı	ı	I	ı	ı	I

The volume of one mole of any gas is  $24\,\mathrm{dm}^3$  at room temperature and pressure (r.t.p.)