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GREENRIDGE SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2020

Secondary 4 Express

CHEMISTRY

6092/01

Paper 1

28 Aug 2020
Friday

1 hour 00 minutes

Additional Materials: MCQ Answer Sheet.

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READ THESE INSTRUCTIONS FIRST

Write your name, register number and class on this cover and all the work you hand in.

Write in soft pencil.

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

The use of an approved scientific calculator is expected, where appropriate.

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 **13**.

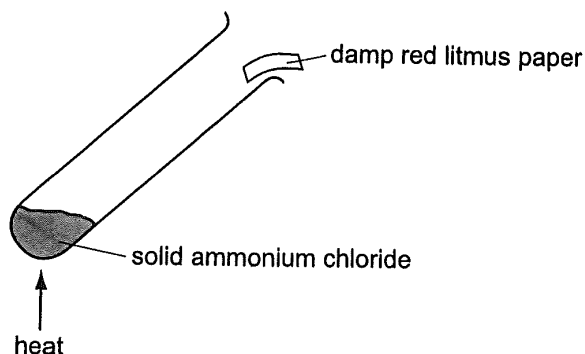
The total number of marks for this paper is **40**.

Section A

This section carries 40 marks.

Answer **all** questions in soft pencil on the OTAS.

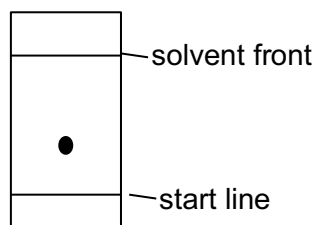
- 1 Solid ammonium chloride decomposes on heating according to the following equation.



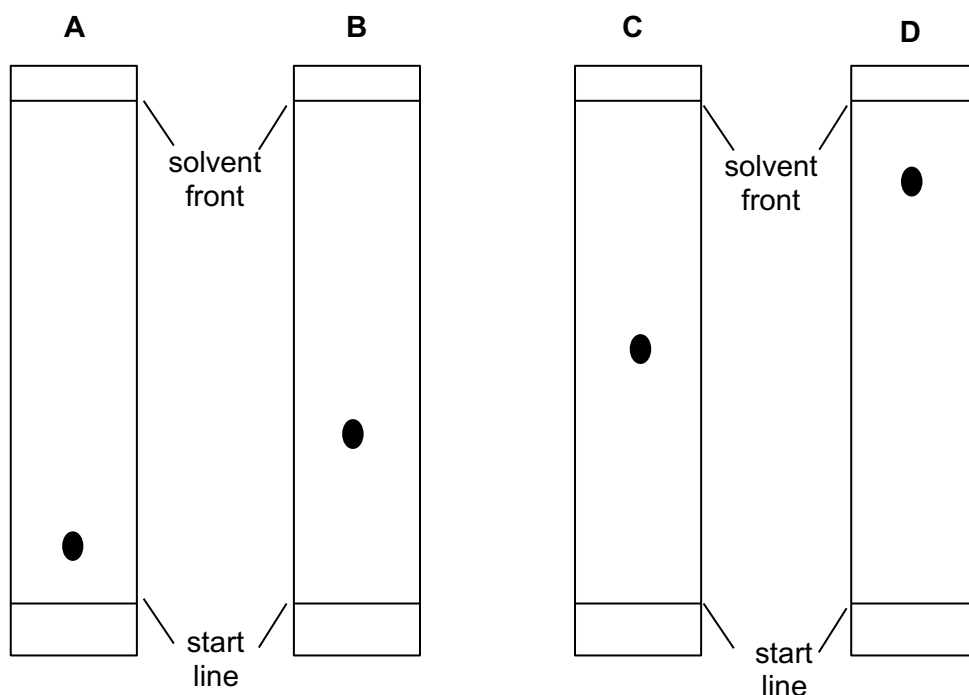
Which change occurs to the damp red litmus paper in the experiment above?

- A bleaches and then turn blue
 - B turns blue and is then bleached
 - C turns blue and remains blue
 - D turns blue and then turns red
- 2 Which chemical could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?
- A aqueous ammonia
 - B aqueous barium chloride
 - C aqueous silver nitrate
 - D aqueous sodium carbonate
- 3 Three elements X, Y, and Z have consecutive, increasing proton (atomic) numbers. Element X exists as colourless, monatomic gas at room temperature. What will be the symbol for the ion of Z?
- A Z^+
 - B Z^-
 - C Z^{2+}
 - D Z^{2-}

- 4 Chromatography was carried out on a food dye using water. After drying, the chromatogram is shown in the diagram.



Chromatography is then carried out on the same food dye using a longer chromatography paper using the same solvent.



Which chromatogram would be the correct result?

- 5 In which compound does one of the atoms **not** achieve the electronic configuration 2,8?

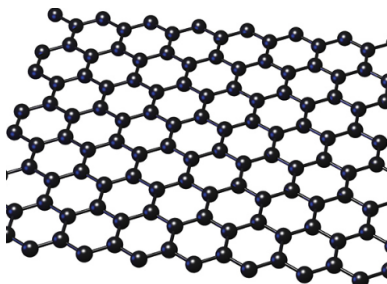
- A CS_2
- B CO_2
- C MgO
- D NaF

- 6 Metals exists as positive ions in a 'sea of delocalised electrons'.

Which metal atom provides the most number of moles of delocalised electrons?

- A aluminium
- B copper
- C magnesium
- D sodium

- 7 Graphene, an allotrope of carbon, is a newly discovered material made from honeycomb sheets of carbon just one atom thick.



structure of graphene

Which substance could be graphene?

	melting point / °C	boiling point / °C	electrical conductivity in solid state
A	–32	27	poor
B	63	759	good
C	3425	3990	poor
D	3652	4200	good

- 8 The melting point of aluminium oxide is much higher than the melting point of calcium oxide. Which statement explains this?

- A** Aluminium is less reactive than calcium and hence form a more stable bond.
B Aluminium metal has higher melting point than calcium metal.
C An aluminium ion has a larger charge than a calcium ion.
D An aluminium ion has lesser electron shells than a calcium ion.

- 9 Element Z has two electrons in its outer shell. What is the formula and nature of the oxide of element Z?

	formula	nature of the oxide
A	ZO	acidic
B	ZO	basic
C	Z ₂ O	acidic
D	Z ₂ O	basic

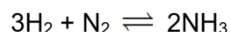
- 10 100 cm³ of 2.0 mol/dm³ copper(II) sulfate solution is mixed with 100 cm³ of 1.0 mol/dm³ sodium carbonate solution in a beaker and stirred.

What does the reaction vessel now contain?

- A a green precipitate and a blue solution
 - B a green precipitate and a colourless solution
 - C a pale blue solution only
 - D a white precipitate and a colourless solution
- 11 Melamine (C₃H₆N₆) is sometimes illegally added to milk products to increase their nitrogen content.

What is the percentage by mass of nitrogen in melamine by mass?

- A 11.1%
 - B 63.6%
 - C 66.7%
 - D 84.0%
- 12 In Haber process, hydrogen reacts with nitrogen to form ammonia gas.



When 60 dm³ of hydrogen is reacted with 28 g of nitrogen gas, 30 dm³ of ammonia gas is produced.

What is the percentage yield of ammonia?

- A 25%
 - B 50%
 - C 75%
 - D 100%
- 13 Which substance is used to decrease the acidity in a soil?
- A ammonium nitrate
 - B calcium hydroxide
 - C magnesium carbonate
 - D sodium hydroxide
- 14 Which pair of reactants would **not** react to form a salt?
- A copper(II) sulfate and sodium hydroxide
 - B copper(II) carbonate and dilute sulfuric acid
 - C copper(II) oxide and carbon monoxide
 - D copper(II) oxide and dilute nitric acid

- 15** When aqueous copper(II) sulfate is added to a solution containing a mixture of the nitrates of calcium, potassium and zinc, a white precipitate forms.

What is the precipitate?

- A** calcium sulfate
- B** copper(II) nitrate
- C** potassium sulfate
- D** zinc sulfate

- 16** Dilute sulfuric acid can react with copper(II) oxide and iron(II) oxide respectively.

In what way are these two reactions similar?

- A** A coloured precipitate is formed.
- B** A coloured solution is formed.
- C** Both are endothermic reactions.
- D** Both are redox reactions.

- 17** Two aqueous solutions, X and Y, are mixed together.

Which pair would **not** give a precipitate?

	solution X	solution Y
A	aqueous ammonia	iron(II) sulfate
B	calcium nitrate	sulfuric acid
C	lead(II) nitrate	calcium chloride
D	zinc sulfate	sodium chloride

- 18** Sulfur dioxide is bubbled into acidified aqueous potassium manganate(VII), and into aqueous potassium iodide solution separately.

Which observations would be made?

	acidified potassium manganate(VII)	aqueous potassium iodide
A	colourless to purple	brown to colourless
B	purple to colourless	brown to colourless
C	purple to colourless	colourless to brown
D	purple to colourless	remains colourless

- 19** A solution X forms a white precipitate with dilute sulfuric acid and also with aqueous silver nitrate.
What could solution X contain?
- A** barium chloride
 - B** barium nitrate
 - C** zinc chloride
 - D** zinc sulfate
- 20** Which process does **not** involve the reduction of copper(II) ion?
- A** adding magnesium into aqueous copper(II) sulfate
 - B** dissolving copper(II) oxide in dilute sulfuric acid
 - C** electrolysis of aqueous copper(II) sulfate
 - D** heating a mixture of carbon and copper(II) oxide
- 21** Which metal can be extracted by heating with carbon?
- A** aluminium
 - B** barium
 - C** lithium
 - D** zinc
- 23** Iron is formed in the blast furnace.
Which statements are correct?
- 1 Calcium oxide is decomposed at a high temperature.
 - 2 Silicon(IV) oxide is reduced by calcium oxide.
 - 3 Carbon is oxidised by hot air.
 - 4 Both carbon and carbon monoxide act as reducing agents.
- A** 1, 2 and 3 only
 - B** 1 and 3 only
 - C** 2 and 4 only
 - D** 3 and 4 only

23 Brass is an alloy of copper and zinc.

Which statement is correct?

- A** Brass contains a higher percentage of zinc than copper.
- B** Brass has a melting point higher than both zinc and copper.
- C** Brass is less malleable than pure copper.
- D** Copper atoms are the same size as zinc atoms.

24 What will happen when copper(II) sulfate solution is stored in a container made of zinc?

- A** Blue solution becomes faded.
- B** Blue solution turns green.
- C** Bubbles of hydrogen will appear on the surface.
- D** There will be no visible reaction.

25 Which reaction would you expect to take place?

- A** $2\text{H}^+(\text{aq}) + \text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{H}_2(\text{g})$
- B** $\text{Cu}^{2+}(\text{aq}) + \text{Mg}(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{Cu}(\text{s})$
- C** $\text{Fe}^{2+}(\text{aq}) + \text{Cu}(\text{s}) \rightarrow \text{Fe}(\text{s}) + \text{Cu}^{2+}(\text{aq})$
- D** $\text{Mg}^{2+}(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{Mg}(\text{s}) + \text{Fe}^{2+}(\text{aq})$

26 Aluminium is obtained by electrolysis of molten aluminium oxide.

Which statement about this electrolysis is correct?

	aluminum ions undergo	aluminium formed at
A	oxidation	anode
B	oxidation	cathode
C	reduction	anode
D	reduction	cathode

27 An aqueous solution of silver nitrate was electrolysed using graphite electrodes.

What is the solution left behind at the end of the electrolysis process?

- A** nitric acid
- B** silver hydroxide
- C** silver nitrate
- D** water

- 28** In the extraction of sodium by electrolysis of molten sodium oxide, 115 g of sodium is collected at the cathode.

What is the volume of oxygen gas formed at the anode, measured at r.t.p.?

- A** 15 dm³
- B** 30 dm³
- C** 60 dm³
- D** 90 dm³

- 29** Fluorine is the first element in Group VII of the Periodic Table.

Which statement about fluorine is correct?

- A** Fluorine exists as monatomic atoms.
- B** Fluorine forms a coloured compound with sodium.
- C** Fluorine is a strong reducing agent.
- D** Fluorine is pale yellow in colour.

- 30** The table gives the formulae of the catalysts used in some industrial processes.

process	catalyst
Contact process	V ₂ O ₅
Haber process	Fe + Mo
cracking of gas oil	Al ₂ O ₃ + SiO ₂
making nitric acid	Pt + Rh
making synthesis gas	Ni

How many different transition metals are included (as elements or as compounds) in the list of catalysts?

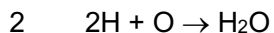
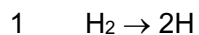
- A** 4
- B** 5
- C** 6
- D** 7

- 31** Element X forms an oxide of formula X₂O₅.

In which group of the Periodic Table is X likely to be found?

- A** Group II
- B** Group III
- C** Group V
- D** Group VII

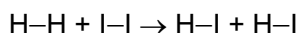
32 The equations for three reactions are given below.



Which of these reactions are endothermic?

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

33 The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.



What may be deduced from this information?

- A** The formation of H–I bonds is highly endothermic.
- B** The number of bonds broken is more than the number of bonds formed.
- C** The products possess less energy than the reactants.
- D** The total energy change during bond formation is less than that during bond breaking.

34 The table shows the energy released by the complete combustion of some common fuels.

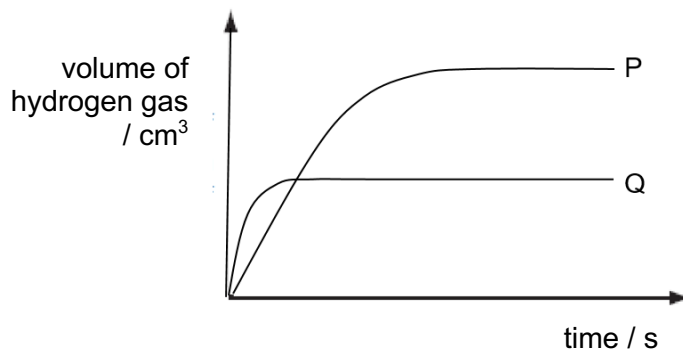
fuel	formula of fuel	molar mass (g/mol)	enthalpy change (kJ/mol)
butane	C_4H_{10}	58	2878
ethanol	$\text{C}_2\text{H}_5\text{OH}$	46	1366
hydrogen	H_2	2	286
methane	CH_4	16	890

Which fuel produces the most energy when 1 g of the compound is completely burnt?

- A** butane
- B** ethanol
- C** hydrogen
- D** methane

- 35 Aqueous hydrogen peroxide decomposes to form water and oxygen gas.
Which factor is least likely to speed up the decomposition of hydrogen peroxide?
- A Addition of manganese(IV) oxide to the aqueous hydrogen peroxide..
 - B Increase the concentration of aqueous hydrogen peroxide.
 - C Increase the pressure on aqueous hydrogen peroxide.
 - D Warm the aqueous hydrogen peroxide.

- 36 Graph P shows the result when 200 cm³ of 1.0 mol/dm³ sulfuric acid is reacted with excess magnesium ribbon.



- Which quantity would produce graph Q?
- A 25 cm³ of 2.0 mol/dm³ sulfuric acid
 - B 50 cm³ of 1.0 mol/dm³ sulfuric acid
 - C 50 cm³ of 2.0 mol/dm³ sulfuric acid
 - D 100 cm³ of 2.0 mol/dm³ sulfuric acid
- 37 Ammonia may be produced by heating ammonium chloride with
- A aqueous bromine.
 - B aqueous nitric acid.
 - C aqueous sodium hydroxide.
 - D aqueous sodium nitrate.

38 Which methods help reduce the amount of carbon dioxide in the air?

- 1 Remove carbon dioxide produced from factories by passing it through calcium oxide.
- 2 Use renewable energy such as solar energy instead of fossil fuel.
- 3 Install catalytic converter in car exhaust system.

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

39 An atmospheric pollutant can be removed by the process of oxidation.

Which pollutant is removed by this process?

- A** carbon monoxide in a catalytic convertor
B nitrogen dioxide in acid rain by reaction with calcium carbonate
C nitrogen oxide in a catalytic convertor
D sulfur dioxide from flue gases by reaction with calcium carbonate

40 In what way do carbon dioxide, CFC and sulfur dioxide affect the atmosphere and the environment?

	carbon dioxide	CFC	sulfur dioxide
A	acid rain	global warming	depletion of ozone
B	depletion of ozone	depletion of ozone	acid rain
C	global warming	acid rain	depletion of ozone
D	global warming	depletion of ozone	acid rain

END OF PAPER

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	euporium	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.).