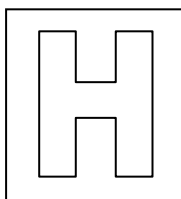


Candidate Name: _____

Class Adm No

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2021 Preliminary Examination Pre-University 3

H2 CHEMISTRY

9729/01

Paper 1 Multiple Choice

21 Sep 2021

1 hour

Additional materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Do not turn over this question paper until you are told to do so

Write in soft pencil.

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

Write your name, class and admission number in the spaces provided at the top of this page and on the Multiple Choice Answer Sheet provided.

There are **thirty** 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 provided.

Read the instructions on the Multiple Choice 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 question paper.

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

FOR EXAMINER'S USE	
TOTAL (30 marks)	

For each question there are four possible answers, **A**, **B**, **C**, and **D**. Choose the **one** you consider to be correct.

- 1** Which of the following contains the same number of stated particles as the number of atoms in 19.0 g of fluorine gas?

- 1 Number of molecules in 2.0 g of hydrogen gas
- 2 Number of ions in 58.5 g of sodium chloride solid
- 3 Number of atoms in 14.0 g of nitrogen gas
- 4 Number of atoms in 12.0 g of graphite

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

- 2** 20 cm³ of an unknown hydrocarbon was completely combusted in excess oxygen gas. Upon cooling back to room temperature and pressure, the total volume of gases was 50 cm³ less than the initial total volume. After passing the remaining gases through KOH(aq), the volume of gases further decreased by 80 cm³.

What is the molecular formula of the unknown hydrocarbon?

A C₂H₄ **B** C₄H₄ **C** C₄H₆ **D** C₄H₈

- 3** Which of the following statements is **incorrect** about the following reaction?



- A** It is a displacement reaction.
- B** The oxidation number of V in VO₃⁻ is +5.
- C** VO₂⁻ is acting as a reducing agent.
- D** VO₂⁻ is acting as an oxidising agent.

- 4 Use of the *Data Booklet* is relevant to this question.

A copper rod weighing 15 g was dipped into 50 cm³ of 2.00 mol dm⁻³ AgNO₃ solution. Silver crystals were observed to grow on the copper rod after a while.

Which of the following statements are correct?

- 1 The $E_{\text{cell}}^{\ominus}$ of the reaction is +1.14V.
- 2 The solution turns blue.
- 3 6.35 g of copper would have reacted upon completion of reaction.

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

- 5 Which of the following statements is **not** true about lithium?

- A** It has a naturally occurring isotope which contains 3 neutrons.
B It has a naturally occurring isotope which contains 4 neutrons.
C It has the full electronic configuration 2s¹.
D It forms an ion with a +1 oxidation number.

- 6 Which of the following properties can be explained by hydrogen bonding?

- 1 The higher density of ice compared to liquid water.
- 2 The ability of water glider insects to float on water.
- 3 Ethanoic acid having an apparent molecular mass of 120.0 in non-polar solvents.

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

- 7 Two elements **D** and **E** have the following properties.

	D	E
Melting point / °C	3600	–38
Appearance	Dull	Shiny
Electrical conductivity when solid	Yes	Yes

What are the likely identities of **D** and **E**?

	D	E
A	SiO ₂	H ₂
B	MgO	Si
C	Si	Na
D	C	Hg

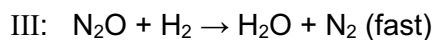
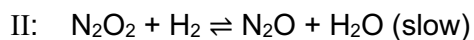
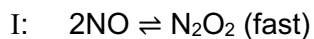
- 8 Which of the following statements best explains the following observation?

Melting point of NaBr / °C	747
Melting point of MgBr ₂ / °C	711

- A** The size of the anion electron cloud is large and easily distorted.
- B** NaBr has a larger magnitude of lattice energy than MgBr₂.
- C** There are more bromide ions in MgBr₂ than in NaBr.
- D** Magnesium has a higher charge and smaller size than sodium.
- 9 Which of the following statements about the standard enthalpy change of neutralisation is true?
- A** It has a constant magnitude of 57.3 kJ mol^{–1}.
- B** It has a smaller magnitude for the reaction between a weak acid and strong base.
- C** It is defined as the energy released when 1 mole of an acid reacts with 1 mole of a base.
- D** It is an endothermic reaction.

- 10 Which of the following statements best describes why the enthalpy change of solution for lithium chloride, LiCl(s) , is more exothermic than that for sodium fluoride, NaF(s) ?
- A The $\Delta H_{\text{hydration}}^{\ominus}$ of $\text{Li}^+(\text{g})$ is more exothermic than that of $\text{Na}^+(\text{g})$.
B The $\Delta H_{\text{hydration}}^{\ominus}$ of $\text{F}^-(\text{g})$ is more exothermic than that of $\text{Cl}^-(\text{g})$.
C The lattice energy of LiCl(s) is more exothermic than that of NaF(s) .
D The 1st electron affinity of sodium is more exothermic than that of lithium.
- 11 What is the identity of the gas which has a density of 89.8 g m^{-3} at 7862 Pa and 22 °C?
Assume the gas behaviour to be ideal.
- A He
B Ne
C N_2
D H_2
- 12 Which of the following is a conjugate acid-base pair?
- A HCl , H^+ B H_2SO_4 , SO_4^{2-} C CO_2 , H_2CO_3 D NH_3 , NH_4^+
- 13 The half-life for a certain first order reaction is 2 hours.
How much time is required to form 25% of the products?
- A 0.8 hours
B 2 hours
C 3 hours
D 4 hours

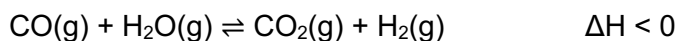
- 14 A reaction between NO and H₂ has the following suggested mechanism.



Which of the following correctly describes the rate equation?

- A** rate = $k [\text{NO}]^2$
B rate = $k [\text{NO}]^2 [\text{H}_2]$
C rate = $k [\text{NO}]^2 [\text{N}_2\text{O}_2] [\text{H}_2]$
D rate = $k [\text{N}_2\text{O}_2] [\text{H}_2]$

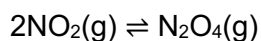
- 15 Which of the following factors, when increased, will affect the position of equilibrium for the following reaction?



- 1 Concentration of CO(g)
2 Total pressure
3 Temperature
4 Volume of the container

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

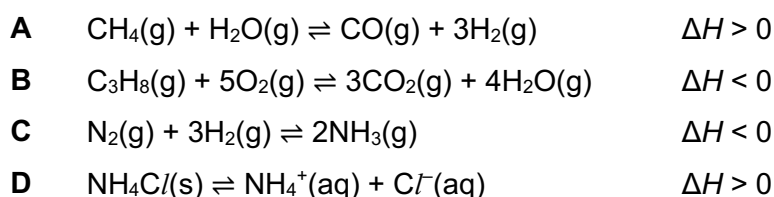
- 16 Nitrogen dioxide, NO₂(g), was placed into a closed vessel of fixed volume and allowed to reach dynamic equilibrium. The equilibrium has a K_c value of 4.0×10^{-2} at a certain temperature.



What is the initial concentration of NO₂(g) if its equilibrium concentration was 0.50 mol dm⁻³?

- A** 0.48 mol dm⁻³
B 0.51 mol dm⁻³
C 0.52 mol dm⁻³
D 0.70 mol dm⁻³

- 17 Given the formula, $\Delta G = -RT \ln K_c$, which of the following reactions will have an equilibrium constant value that is greater than 1 at all temperatures?



- 18 Which of the following mixtures will form an alkaline buffer?

- A** 1 mole of CH_3COOH and 1 mole of $\text{CH}_3\text{COO}^-\text{Na}^+$
B 2 moles of CH_3COOH and 1 mole of NaOH
C 2 moles of $\text{CH}_3\text{CH}_2\text{NH}_2$ and 1 mole of NaOH
D 2 moles of $\text{CH}_3\text{CH}_2\text{NH}_2$ and 1 mole of HCl

- 19 The K_w of water is $5.13 \times 10^{-13} \text{ mol}^2 \text{ dm}^{-6}$ at 100°C .

What is the pH of water at 100°C ?

- A** 6.14
B 7.00
C 7.16
D 12.29

- 20 An aqueous solution of compound **G** ($\text{p}K_a = 4.70$) is titrated against an aqueous solution of compound **H** ($\text{p}K_a = 13.8$).

Which of the following is the most suitable indicator for the titration?

	Indicator	pH Range
A	α -Naphthyl red	3.7-5.0
B	Bromocresol purple	5.2-6.8
C	Bromophenol blue	6.2-7.6
D	Thymolphthalein	9.4-10.6

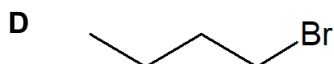
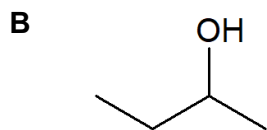
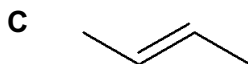
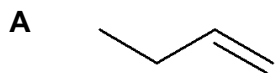
- 21 Solid sodium carbonate is gradually added in small amounts to a solution containing a mixture of $0.0100 \text{ mol dm}^{-3}$ of Ag^+ ions and $0.0100 \text{ mol dm}^{-3}$ of Cu^{2+} ions until in excess.

Which of the following observations are correct?

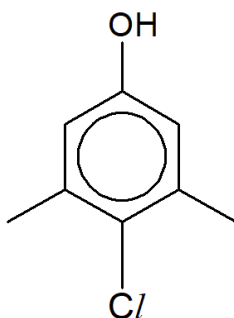
$$[K_{\text{sp}}(\text{Ag}_2\text{CO}_3) = 8.1 \times 10^{-12}; K_{\text{sp}}(\text{CuCO}_3) = 2.5 \times 10^{-10}]$$

- A Only a white precipitate of Ag_2CO_3 will be seen.
 - B Only a green precipitate of CuCO_3 will be seen.
 - C A green precipitate of CuCO_3 will be seen first, followed by white precipitate of Ag_2CO_3
 - D A white precipitate of Ag_2CO_3 will be seen first, followed by green precipitate of CuCO_3
- 22 Which of the following set of reagents is unable to react with ethene?
- A Br_2 in methylbenzene solvent
 - B H_2 with palladium at high temperatures
 - C Hot alkaline KMnO_4
 - D LiAlH_4 in dry ether

- 23 Which of the following compounds **cannot** be formed from 2-bromobutane in one step?



- 24** Chloroxylenol is one of the approved active ingredients in the disinfectants used for deep-cleaning places visited by Covid-19-positive persons.



chloroxylenol

Which of the following reagents will produce a positive test with the chloroxylenol?

- 1 Hot $\text{AgNO}_3(\text{aq})$
- 2 Neutral $\text{FeCl}_3(\text{aq})$
- 3 Hot acidified $\text{KMnO}_4(\text{aq})$

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

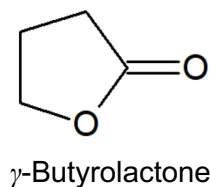
- 25** How many possible non-cyclic constitutional isomers and stereoisomers are there with the molecular formula $\text{C}_3\text{H}_5\text{Br}$?

- A** 2
B 3
C 4
D 5

- 26** Which of the following sequence of steps allows for butanone to be formed from but-1-ene?

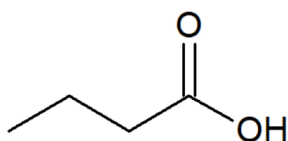
- | | step 1 | step 2 |
|----------|----------------|-----------|
| A | addition | oxidation |
| B | hydrolysis | oxidation |
| C | mild oxidation | oxidation |
| D | oxidation | reduction |

- 27 γ -Butyrolactone (gamma-butyrolactone) was used as a drug to increase sleep related growth hormone secretion, and was sold as a nutritional supplement until it was banned due to its severe negative side effects on the human body.

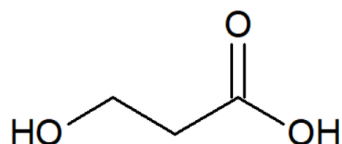


Which of the following compounds can be used to form γ -butyrolactone in one step?

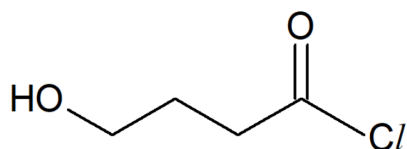
1



2



3



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

- 28 Which of the following factors help to explain the reducing strength of group 2 metals?

- 1 number of electron shells
- 2 charge
- 3 ionic radius

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

- 29 In Crystal Field Theory, ligands that bond to the central metal ion cause a splitting of d-orbitals. Assuming that the octahedral complexes below have a large energy gap between the split d-orbitals, which of the following central metal ions is likely to have the highest number of unpaired electrons in the ground state?

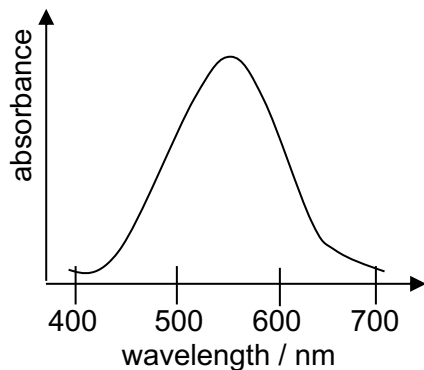


- 30 Aqueous ions of transition metals are usually coloured.

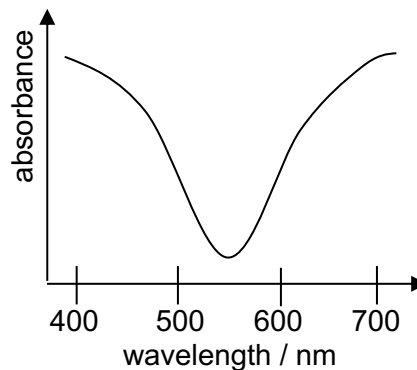
colour	violet	blue	green	yellow	orange	red
corresponding wavelength / nm	400	450	550	580	600	700

Which of the following absorption spectra will be produced by aqueous iron(II) ions?

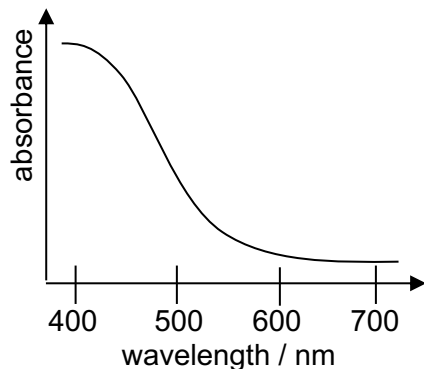
A



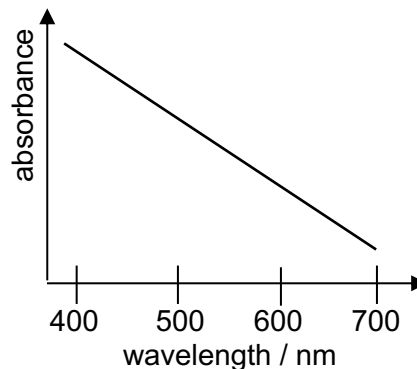
C



B



D



END OF PAPER 1

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