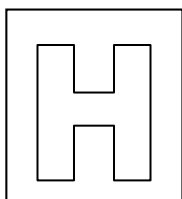


Candidate Name: \_\_\_\_\_

Class    Adm No

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## 2018 Preliminary Examinations Pre-University 3

### H2 CHEMISTRY

9729/01

Paper 1 Multiple Choice

21 Sept 2018

1 hour

Additional materials: Multiple Choice Answer Sheet  
Data Booklet

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#### 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)	

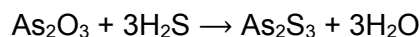
- 1 *Use of the Data Booklet is relevant to this question.*

Which sample of gas below contains the same number of particles as 19.0 g of fluorine gas?

- 1 2.0 g of helium gas
- 2 10.1 g of neon gas
- 3 17.0 g of ammonia gas

- |                       |                     |
|-----------------------|---------------------|
| <b>A</b> 1 only       | <b>B</b> 3 only     |
| <b>C</b> 1 and 2 only | <b>D</b> 1, 2 and 3 |

- 2 Arsenic in the form of arsenic trioxide,  $\text{As}_2\text{O}_3$ , was used in the past as rat poison. To test for the presence of  $\text{As}_2\text{O}_3$ , 1.0 g sample containing some  $\text{As}_2\text{O}_3$  is dissolved and excess  $\text{H}_2\text{S}$  is then added to the solution. 0.492 g of  $\text{As}_2\text{S}_3$  is precipitated as a result. The equation for the reaction is given below:



What is the percentage by mass of arsenic in the original sample?

- A** 15.9%
- B** 29.0%
- C** 39.5%
- D** 86.5%

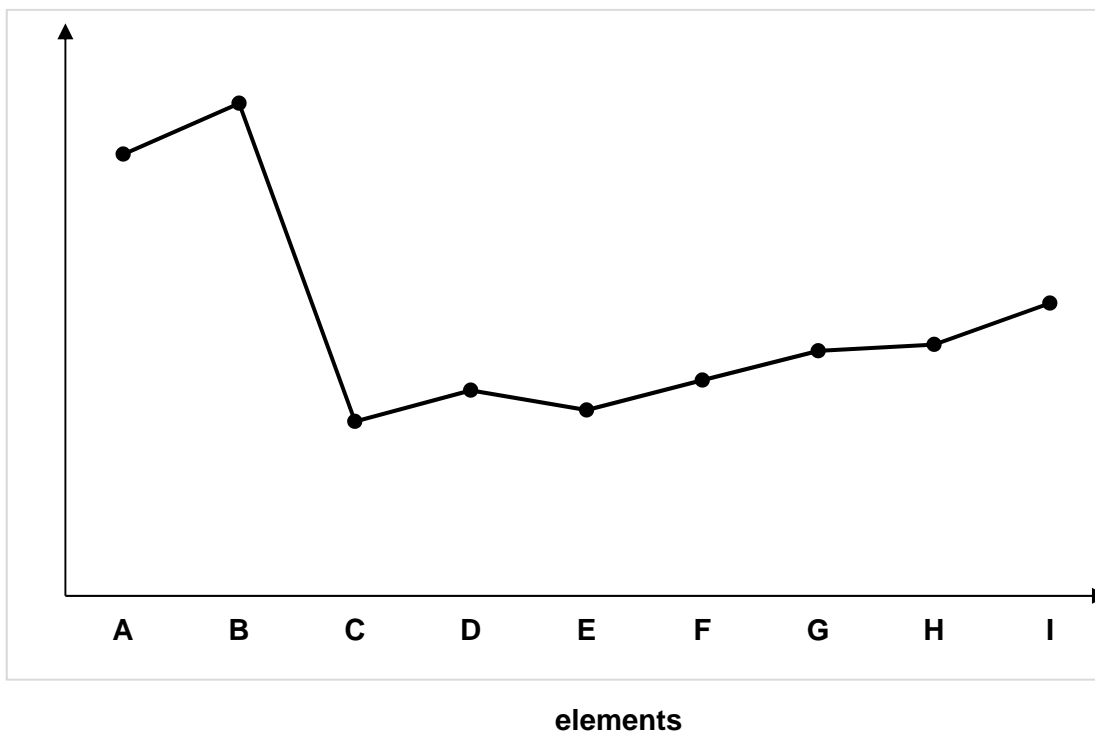
- 3 *Use of the Data Booklet is relevant to this question.*

Tin(II) ions can be used as a reducing agent. What volume of  $0.025 \text{ mol dm}^{-3}$  of tin(II) ions is needed to completely reduce  $5 \times 10^{-4} \text{ mol}$  of potassium manganate(VII)?

- |                              |                              |
|------------------------------|------------------------------|
| <b>A</b> $8.00 \text{ cm}^3$ | <b>B</b> $16.0 \text{ cm}^3$ |
| <b>C</b> $25.0 \text{ cm}^3$ | <b>D</b> $50.0 \text{ cm}^3$ |

- 4 The graph below shows the 3<sup>rd</sup> ionisation energies of elements **A** to **I**, which are consecutive elements with atomic number less than 20.

Third ionisation energy



Which of the following statements is correct?

- A** The 3<sup>rd</sup> ionisation energy of **B** is the highest as it is the removal of an inner shell electron.
- B** Element **A** is a noble gas.
- C** Element **E** has a lower 3<sup>rd</sup> ionisation energy than element **D** because of inter-electronic repulsion from the paired 2p electrons.
- D** Element **G** has a higher 3<sup>rd</sup> ionisation energy than element **F** because of higher shielding effect.
- 5 A sample of  ${}^9\text{Be}^{2+}$  ions are passed through some charged electrical plates. The angle of deflection of the  ${}^9\text{Be}^{2+}$  ions is  $12.0^\circ$ .  
Another sample of doubly charged **X** ions are also passed through the same electrical plates and deflected at an angle of  $-6.75^\circ$ . What is the mass number of **X**?

- |             |             |
|-------------|-------------|
| <b>A</b> 4  | <b>B</b> 8  |
| <b>C</b> 10 | <b>D</b> 16 |

- 6 Which of the following statements is true about graphite and diamond?
- 1 Only covalent bonds are present in the structures for both graphite and diamond.
  - 2 The bond angle about the C-C-C is  $109.5^\circ$  for both graphite and diamond.
  - 3 C-C covalent bonds in diamond are longer than the C-C covalent bonds in graphite
- A 1 only                                      **B** 3 only  
C 1 and 2 only                                D 1 and 3 only
- 7 In which set of species do all three compounds have the same shape?
- A  $\text{CO}_2$ ,  $\text{NO}_2$ ,  $\text{SO}_2$   
B  $\text{BF}_3$ ,  $\text{AlCl}_3$ ,  $\text{PBr}_3$   
**C**  $\text{CH}_4$ ,  $\text{SiH}_4$ ,  $\text{GeH}_4$   
D  $\text{BeF}_2$ ,  $\text{CO}_2$ ,  $\text{H}_2\text{S}$
- 8 2.90 g of potassium fluoride was dissolved in 100 g of water. The temperature rise measured was  $5.1^\circ\text{C}$ . If the enthalpy change of hydration of  $\text{K}^+$  and  $\text{F}^-$  are  $-320 \text{ kJ mol}^{-1}$  and  $-524 \text{ kJ mol}^{-1}$  respectively, what is the lattice energy of potassium fluoride?  
Assume that specific heat capacity of water is  $4.2 \text{ J g}^{-1} \text{ K}^{-1}$ .
- A**  $-801 \text{ kJ mol}^{-1}$     B  $-887 \text{ kJ mol}^{-1}$     C  $+801 \text{ kJ mol}^{-1}$     D  $+887 \text{ kJ mol}^{-1}$
- 9 Which of the following reactions has a positive entropy change?
- A  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$   
**B**  $\text{CO}_2(\text{g}) + \text{C}(\text{s}) \rightarrow 2\text{CO}(\text{g})$   
C  $\text{Fe}(\text{s}) + \text{S}(\text{s}) \rightarrow \text{FeS}(\text{s})$   
D  $\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$

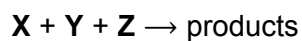
10 At room temperature and pressure, which of the following gases has the greatest deviation from ideal gas behaviour?

- A helium  
B sulfur dioxide  
C carbon dioxide  
D methane

11 Which of the following is a conjugate acid-base pair?

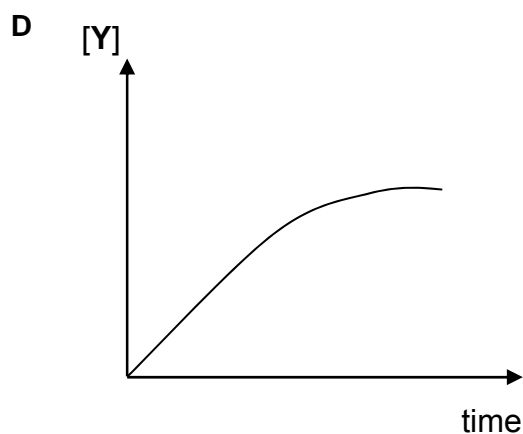
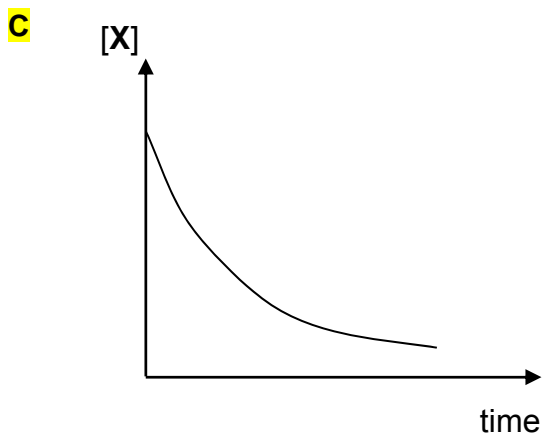
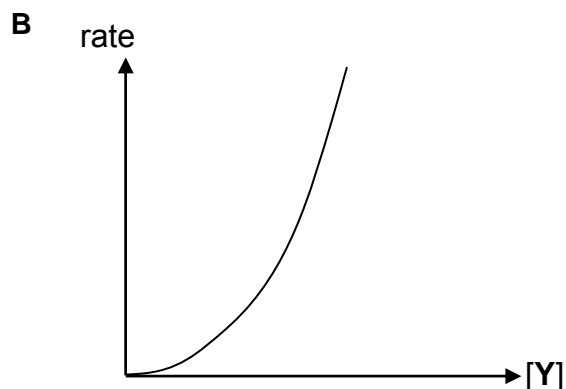
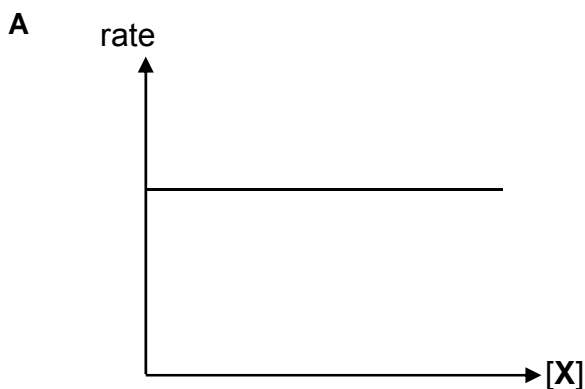
- A  $\text{CO}_2/\text{CO}_3^{2-}$   
B  $\text{HCl}/\text{NaOH}$   
C  $\text{H}_2\text{O}/\text{OH}^-$   
D  $\text{H}_2\text{SO}_4/\text{SO}_4^{2-}$

12 X, Y and Z react together to give some products as shown.



The rate equation of the reaction above can be written as  $\text{rate} = k[\text{X}][\text{Y}]$ .

Which of the following graphs is correct of the reaction above?



13 Which of the following statements is true about enzymes?

- 1 Enzymes lose their catalytic properties at high temperatures.
- 2 They are specific towards particular substrates.
- 3 They help to break down larger molecules into smaller ones.

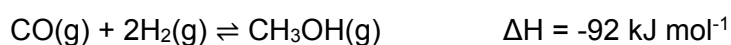
**A** 1 and 2 only

**B** 2 and 3 only

**C** 1 only

**D** 3 only

14 Consider the following reaction:



Which of the following statements is correct about the above reaction?

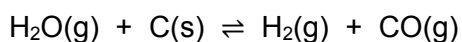
**A** The equilibrium constant increases as a catalyst is added.

**B** When more hydrogen gas is added to the system, the equilibrium position shifts left.

**C** When temperature increases, the yield of the product increases.

**D** When pressure increases, the yield of the product increases.

15 A mixture of powdered coal and steam at a pressure of 1 atm and a temperature of 1300 °C was allowed to reach equilibrium as shown in the equation below.

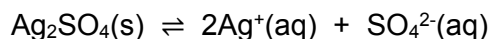


It was found that the total pressure had increased to 1.9 atm but the remaining steam had a partial pressure of only 0.1 atm.

Which of the following shows the partial pressure of carbon monoxide and the value of  $K_p$  for this equilibrium?

	Partial pressure of CO / atm	$K_p$
<b>A</b>	0.9	8.1
<b>B</b>	0.9	32.4
<b>C</b>	1.8	8.1
<b>D</b>	1.8	32.4

- 16 Sparingly soluble  $\text{Ag}_2\text{SO}_4$  dissociates in aqueous solution according to the following equation.



Given that the solubility product of  $\text{Ag}_2\text{SO}_4$  is  $S$ , what is the concentration of  $[\text{Ag}^+]$  in a saturated solution of  $\text{Ag}_2\text{SO}_4$ ?

A  $\left(\frac{S}{4}\right)^{\frac{1}{3}}$

B  $\sqrt{S}$

C  $\left(\frac{S}{2}\right)^{\frac{1}{3}}$

**D**  $(2S)^{\frac{1}{3}}$

- 17 Which of the following statements is true about aluminium chloride?

- 1 It forms an acidic solution in water.
- 2 It conducts electricity in the solid state.
- 3 It can dimerise through dative bonding.

A 3 only

B 1 and 2 only

**C** 1 and 3 only

D 1, 2 and 3

- 18 Group 2 nitrates decompose in this manner:  $\text{M}(\text{NO}_3)_2 \rightarrow \text{MO}(\text{s}) + 2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$  and require more energy for decomposition down the group. Which factor best explains this trend?

- A electronegativity of group 2 metals
- B stability of group 2 oxides
- C** ionic radii of group 2 metal ions
- D lattice energy of group 2 nitrates

- 19 *The use of Data Booklet is relevant to this question.*

What will be observed when a few drops of acidified aqueous hydrogen peroxide are added to an excess of aqueous potassium iodide?

- A The solution remains colourless and no effervescence occurs.
- B** The solution turns brown and no effervescence occurs.
- C The solution remains colourless and effervescence occurs.
- D The solution turns brown and effervescence occurs.

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

A solution of tin(II) ions is mixed with dichromate(VI) ions. A green solution was observed. What is the standard cell potential of the reaction?

- |          |        |   |        |
|----------|--------|---|--------|
| A        | -1.18V | B | -1.48V |
| <b>C</b> | 1.18V  | D | 1.48V  |

- 21 American pennies are made of copper-coated zinc. Each penny is coated with 0.0625 g of copper metal. How much time is needed to plate one uncoated zinc penny when the penny is placed in a  $0.5 \text{ mol dm}^{-3}$  solution of  $\text{CuSO}_4$  with a current of 0.25 A?

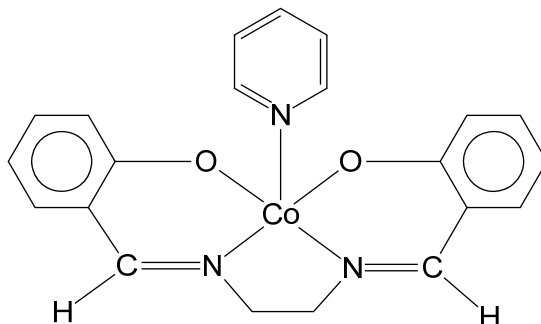
- |   |             |          |             |
|---|-------------|----------|-------------|
| A | 380 seconds | <b>B</b> | 760 seconds |
| C | 380 hours   | D        | 760 hours   |

- 22 Which of the following cannot act as a ligand to form complexes?

- |   |                      |   |               |          |                |   |              |
|---|----------------------|---|---------------|----------|----------------|---|--------------|
| A | $\text{H}_2\text{O}$ | B | $\text{OH}^-$ | <b>C</b> | $\text{AlH}_3$ | D | $\text{HCl}$ |
|---|----------------------|---|---------------|----------|----------------|---|--------------|

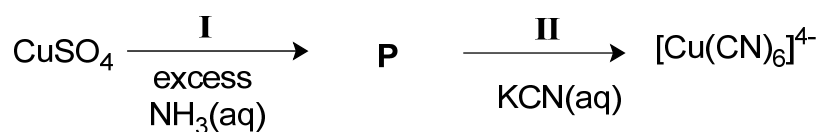


- 23 The following cobalt complex is known to be the functional model for biological oxygen carrier.



What is the electronic configuration of the cobalt cation in the above complex?

- A [Ar]3d<sup>4</sup>      **B** [Ar]3d<sup>7</sup>      C [Ar]3d<sup>5</sup>4s<sup>2</sup>      D [Ar]3d<sup>7</sup>4s<sup>2</sup>
- 24 A solution containing copper(II) sulfate was subjected to a few chemicals as shown in the reaction scheme below.



Which of the following statements are correct about the reaction scheme?

- 1 CN<sup>-</sup> is a stronger ligand than NH<sub>3</sub>.
- 2 The copper in CuSO<sub>4</sub> is reduced.
- 3 Ligand exchange took place in both steps **I** and **II**.

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

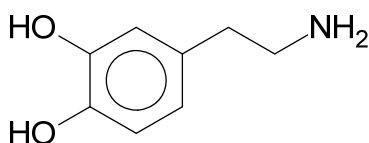
- 25 What is the number of non-cyclic constitutional isomers that can be exhibited by C<sub>3</sub>H<sub>4</sub>Br<sub>2</sub>?

- A 2      B 3      C 4      **D** 5

- 26 Which of the following is a propagation step in the reaction of ethane with bromine in the presence of ultraviolet light?

- A**  $\text{CH}_2\text{BrCH}_2\bullet + \text{Br}_2 \rightarrow \text{CH}_2\text{BrCH}_2\text{Br} + \text{Br}\bullet$   
**B**  $\bullet\text{CHBrCH}_3 + \text{HBr} \rightarrow \bullet\text{CBr}_2\text{CH}_3 + \text{H}_2$   
**C**  $\text{CH}_3\text{CH}_2\bullet + \bullet\text{Br} \rightarrow \text{CH}_3\text{CH}_2\text{Br}$   
**D**  $\text{CH}_3\text{CH}_3 + \text{Br}\bullet \rightarrow \text{CH}_3\text{CH}_2\text{Br} + \text{H}\bullet$

- 27 Dopamine is a neurotransmitter that is involved in addiction.



Dopamine

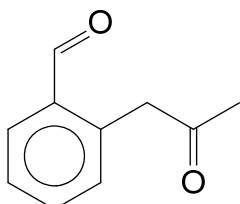
Which of the following statements is true about dopamine?

- 1 It will react with hot sodium hydroxide to produce ammonia.
- 2 One mole of dopamine will react with excess Na(s) to produce 2 moles of  $\text{H}_2(\text{g})$ .
- 3 It can decolourise aqueous bromine.

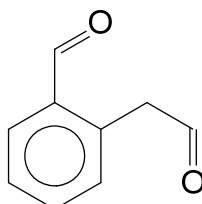
- A** 2 only  
**B** 3 only  
**C** 1 and 2 only  
**D** 2 and 3 only

- 28 Which of the following will give a positive reaction with both Tollens' reagent and aqueous alkaline iodine?

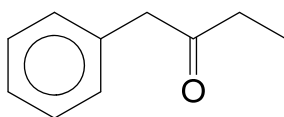
**A**



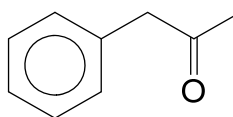
**B**



**C**



**D**



**29** Phenol is weakly acidic and has a  $pK_a$  of 9.95. Which of the following substances, in the presence of water, has a higher  $pK_a$  than phenol?

- |                              |                            |
|------------------------------|----------------------------|
| <b>A</b> chloroethanoic acid | <b>B</b> ethanoyl chloride |
| <b>C</b> 4-chlorophenol      | <b>D</b> ethanol           |

**30** The following fragments were obtained when a polypeptide is hydrolysed.

phe-ser  
ala-ala  
ser-phe-gly  
lys-asp  
ala-lys  
gly-ala

Given that the polypeptide chain is known to have 8 amino acids residues, which of the following could be the polypeptide?

- A** ser-phe-ala-ala-gly-ser-lys-asp  
**B** phe-ser-phe-gly-ala-ala-lys-asp  
**C** phe-ser-ala-gly-ala-ala-lys-asp  
**D** ser-phe-phe-gly-ala-ala-lys-asp

**END OF PAPER**

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