Chemistry

Standard level

Paper 1A

1 hour 30 minutes [Paper 1A and 1B]

Instructions to candidates

- Do not open the examination paper until instructed to do so.
- Answer all questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- A calculator is required for this paper.
- A clean copy of the **chemistry data booklet** is required for this paper.
- The maximum mark for paper 1A is **[30 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.

Section A

1. Which of the following are pure substances?

I. $Na(s)$

II. $NaCl(aq)$

III. $NaCl(s)$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

2. Which equation represents the deposition of CO_2?

A. $CO_2(g) \rightarrow CO_2(aq)$

B. $CO_2(s) \rightarrow CO_2(g)$

C. $CO_2(g) \rightarrow CO_2(s)$

D. $CO_2(s) \rightarrow CO_2(l)$

3. Which of the following electron transitions produces a line in the visible region of the electromagnetic spectrum?

A. $n = 2$ to $n = 3$

B. $n = 4$ to $n = 1$

C. $n = 3$ to $n = 2$

D. $n = 4$ to $n = 3$

4. Which statement is correct about the isotopes of carbon?

   A. They have the same numbers of neutrons.

   B. They have the same physical properties.

   C. They have different numbers of electrons.

   D. They have different mass numbers.

5. Which is the correct electron configuration of the chromium(III) ion, Cr^{3+}?

   A. $[Ar]\ 3d^3$

   B. $[Ar]\ 3d^2\ 4s^1$

   C. $[Ar]\ 3d^1\ 4s^2$

   D. $[Ne]\ 3d^3$

6. Which of the following samples contains the greatest number of oxygen atoms at STP?

   A. 0.50 mol $CuSO_4.5H_2O$

   B. 22.7 dm^3 CO_2

   C. 1.20×10^{24} H_2O water molecules

   D. 64 g O_2

7. Which statement explains the deviation of a real gas from ideal gas behaviour at very high pressures?

   A. Real gases have no intermolecular forces

   B. Real gases have a finite volume

   C. Real gases have no mass

   D. Real gases at STP contain equal numbers of particles

8. What is the correct formula for the compound iron(III) phosphate?

   A. Fe_2PO_4

   B. $Fe_2(PO_4)_3$

   C. $Fe_3(PO_4)_2$

   D. $FePO_4$

9. Which of the following are the properties of an ionic compound?

	Melting Point	**Solubility in water**	**Electrical conductivity**
A.	Low	Insoluble	When molten
B.	High	Soluble	When molten
C.	High	Insoluble	When molten
D.	Low	Soluble	When solid

10. Which statements are correct about covalent bonds?

    I. A double covalent bond consists of three shared pairs of electrons
    II. Single covalent bonds are longer than triple covalent bonds
    III. Double covalent bonds are weaker than triple covalent bonds

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

11. Which is correct about the molecule OF_2?

	Molecular geometry	**Electron domain geometry**	**Bond angle**
A.	Bent	Tetrahedral	$<109.5^{o}$
B.	Bent	Trigonal planar	$<109.5^{o}$
C.	Tetrahedral	Bent	180^{o}
D.	Bent	Tetrahedral	180^{o}

12. Which species are responsible for the electrical conductivity of metals?

A. Mobile ions
B. Lone pairs of electrons
C. Delocalised electrons
D. Atoms with unpaired electrons

13. What is the bonding between two atoms that have electronegativity values of 1.3 and 2.6? Use section 17 of the chemistry data booklet.

    A. Covalent

    B. Polar covalent

    C. Metallic

    D. Ionic

14. Which element has properties of both a metal and a non-metal element?

    A. Na

    B. N

    C. Si

    D. Zn

15. What is correct in order of increasing ionic radius?

    A. $N^{3-} < O^{2-} < F^{-} < Na^{+}$

    B. $Na^{+} < O^{2-} < F^{-} < N^{3-}$

    C. $Na^{+} < F^{-} < O^{2-} < N^{3-}$

    D. $Na^{+} < F^{-} < N^{3-} < O^{2-}$

16. Which of the following contains a sulfur atom with a +6 oxidation state?

I. SO_3

II. SO_4^{2-}

III. $Na_2S_2O_3$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

17. Which of the following compounds are members of the same homologous series?

A. CH_3CH_3, CH_3CHCH_2, $CH_3CH_2CH_2CH_3$, $CH_3CH_2CH_2CH_2CH_3$

B. $HCOOH$, $HCOOCH_3$, $HCOOCH_2CH_3$, $HCOOCH_2CH_2CH_3$

C. CH_3CHO, CH_3CH_2OH, $CH_3CH_2CH_2OH$, $CH_3CH_2CH_2CHO$

D. CH_2CHCH_3, $CH_2CHCH_2CH_3$, $CH_2CHCH_2CH_2CH_3$, $CH_2CHCH_2CH_2CH_2CH_3$

18. Which compounds are functional group isomers?

A. Propanoic acid and propanone

B. Propanal and propanone

C. Propan-1-ol and propan-2-ol

D. Propane and propene

19. Which describes an endothermic reaction?

	ΔH	**More stable**	**Higher potential energy**
A.	Positive	Reactants	Products
B.	Positive	Products	Reactants
C.	Negative	Reactants	Products
D.	Negative	Products	Reactants

20. What volume of $CO_2(g)$ can be produced in the reaction of 8 dm^3 of $CO(g)$ and 8 dm^3 of $O_2(g)$ at STP?

A. 4 dm^3

B. 2 dm^3

C. 8 dm^3

D. 16 dm^3

21. Which of the following combinations would result in the fastest rate of formation of hydrogen gas, $H_2(g)$?

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

	Mg(s)	HCl(aq)
A.	2.00 g powder	25 cm^3 1.00 mol dm^{-3}
B.	2.00 g ribbon	25 cm^3 1.00 mol dm^{-3}
C.	2.00 g ribbon	25 cm^3 2.00 mol dm^{-3}
D.	2.00 g powder	25 cm^3 2.00 mol dm^{-3}

22. Which is always correct for a reaction that has a higher concentration of products at equilibrium?

    I. $K > 1$

    II. $\Delta H < 0$

    III. Equilibrium position lies to the right

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III

23. Which change will shift the equilibrium position to the left and decrease the value of the equilibrium constant, K, for the reaction shown?

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ mol}^{-1}$$

    A. Decreasing the pressure

    B. Increasing the concentration of NH_3

    C. Increasing the temperature

    D. Decreasing the temperature

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

    A. HClO and H_2O

    B. H_3O^+ and OH^-

    C. H_2CO_3 and CO_3^{2-}

    D. HSO_4^- and SO_4^{2-}

25. Which is correct for a solution with a pH of 12 at 298 K?

A. $[H^+] > [OH^-]$

B. $[H^+] = 1.00 \times 10^{-12}$ mol dm^{-3}

C. $[OH^-] = 1.00 \times 10^{-12}$ mol dm^{-3}

D. $[H^+] = 1.00 \times 10^{-2}$ mol dm^{-3}

26. Which is correct about the redox reaction shown?

$$Mg(s) + 2AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2Ag(s)$$

	Reducing agent	**Species reduced**
A.	$Mg(s)$	$Ag^+(aq)$
B.	$Ag^+(aq)$	$Mg(s)$
C.	$Ag(s)$	$Mg^{2+}(aq)$
D.	$Mg^{2+}(aq)$	$Ag^+(s)$

27. Which is correct for a voltaic cell and an electrolytic cell?

I. Oxidation occurs at the anode

II. Electrons flow from anode to cathode

III. The cathode is positive and the anode is negative

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

28. Which compound can undergo oxidation to form a ketone?

A. CH_3CH_2CHO

B. $CH_3CH(OH)CH_3$

C. $CH_3CH_2CH_2OH$

D. CH_3COCH_3

29. Which species is formed during homolytic fission?

A. A positive ion

B. A negative ion

C. A radical

D. A leaving group

30. Which of the following occurs when ethene reacts with hydrogen?

A. Nucleophilic substitution

B. Electrophilic substitution

C. Nucleophilic addition

D. Electrophilic addition