

**GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD**  
General Certificate of Education Examination

**0715 CHEMISTRY 1**

**JUNE 2021**

**ADVANCED LEVEL**

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Centre Name	
Candidate Identification Number	
Candidate Name	<a href="http://www.gcerevision.com">gcerevision.com</a>

**Mobile phones are NOT allowed in the examination room.**

**MULTIPLE CHOICE QUESTION PAPER**

**One and a half hours**

**INSTRUCTIONS TO CANDIDATES**

*Read the following instructions carefully before you start answering the questions in this paper. Make sure you have a soft HB pencil and an eraser for this examination.*

- USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
- DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

*Before the examination begins:*

- Check that this question booklet is headed "Advanced Level - 0715 CHEMISTRY 1"
- Fill in the information required in the spaces above.
- Fill in the information required in the spaces provided on the answer sheet using your HB pencil:  
**Candidate Name, Exam Session, Subject Code and Candidate Identification Number.**  
Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.

*How to answer the questions in this Examination*

- Answer **ALL** the 50 questions in this Examination. All questions carry equal marks.
- Non-programmable calculators are allowed.
- Each question has **FOUR** suggested answers: **A, B, C** and **D**. Decide which answer is appropriate. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square brackets for the answer you have chosen.

For example, if **C** is your correct answer, mark **C** as shown below:

[A] [B] **[C]** [D]

- Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about an answer, erase the first mark carefully, then mark your new answer.
- Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
- Do all rough work in this booklet using the blank spaces in the question booklet.
- At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

-----Turn Over

**JUNE 2021/0715/1/A/MCQ**

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### Questions 1 - 37 (Thirty seven questions).

Directions: Each of the questions or incomplete statements in this section is followed by four suggested answers. Select the best answer in each case.

1. Which of the following is Avogadro number?

(C = 12, O = 16, He = 4, Na = 23)

- A The number of carbon atoms in  $\frac{1}{12}$  g of carbon
- B The number of oxygen molecules in 16 g of oxygen.
- C The number of electrons in 2 g of helium.
- D The number of sodium ions ( $\text{Na}^+$ ) in 23 g.

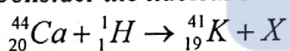
2. 50 cm<sup>3</sup> of 0.01 M  $\text{Ca}(\text{OH})_2$  solution would be exactly neutralized by

- A 5 cm<sup>3</sup> of 0.1 M HCl acid
- B 25 cm<sup>3</sup> of 0.01 M HCl acid
- C 5 cm<sup>3</sup> of 0.1 M  $\text{H}_2\text{SO}_4$  acid
- D 100 cm<sup>3</sup> of 0.01 M  $\text{H}_2\text{SO}_4$  acid

3. When burned, sulphur forms a gaseous product X which can be oxidized to produce a gas Y. Gas Y reacts with water to produce a product Z. Which row correctly shows the oxidation states of sulphur in X, Y and Z?

	X	Y	Z
A	-2	+4	+4
B	-2	+4	+6
C	+4	+6	+4
D	+4	+6	+6

4. Consider the nuclear reaction:



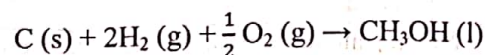
The product X represents

- A Four gamma rays
- B An alpha particle.
- C Two beta particles.
- D Four neutrons

5. Which one of the following statements is NOT true of the line emission spectrum of hydrogen?

- A If only a single atom of hydrogen were present, then only a single wavelength would be observed at a given instant.
- B Several lines are observed because the sample contains many hydrogen atoms that are in different initial energy states and reach different final energy states.
- C Each line represents the wavelength of a photon emitted when an electron moves from a lower energy level to a higher energy level.
- D A single electron can transit to different energy levels

6. The standard enthalpy changes of combustion of carbon, hydrogen and methanol are:  $-394 \text{ kJ mol}^{-1}$ ,  $-286 \text{ kJ mol}^{-1}$  and  $-726 \text{ kJ mol}^{-1}$  respectively. From the equation:



Which expression gives the standard enthalpy change of formation of methanol in  $\text{kJ mol}^{-1}$ ?

- A  $-394 + (-286) - (-726)$
- B  $-394 + (-286 \times 2) - 726$
- C  $-394 + (-286 \times 2) - (-726)$
- D  $-726 - (-394) - (-286 \times 2)$

7. The pairs of numbers shown below represent respectively the theoretical and experimental lattice energies (in  $\text{kJ mol}^{-1}$ ) of a series of crystals. Which pair of these values best fits the simple electrostatic model of an ionic crystal?

- A  $-630.9$  and  $-631.8$
- B  $-768.5$  and  $-916$
- C  $-3427$  and  $-3615$
- D  $-2740$  and  $-2960$

8. In the determination of crystal structures by X-ray diffraction, the X-rays incident on the crystal are diffracted by

- A Atomic nuclei
- B Electrons
- C Neutrons
- D Protons

9. Crystal structures can be classified as either body-centered cubic (bcc), face-centered cubic (fcc), hexagonal closest packed (hcp) or cubic-closest packed (ccp). Which of the following information is true?

	Type of crystal structure	Coordination number	Number of atoms per unit cell
A	bcc	8	2
B	fcc	12	6
C	hcp	12	4
D	ccp	12	8



10. The boiling points of methane, ethane, propane and butane are given.

Compound	CH <sub>4</sub>	CH <sub>3</sub> CH <sub>3</sub>	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>
Boiling point /K	112	185	231	273

Which statement explains the increase in boiling point from methane to butane?

- A Closer packing of molecules results in stronger van der Waals' forces.  
 B More covalent bonds are present and therefore more energy is required to break the bonds.  
 C More electrons in the molecules results in stronger van der Waals' forces.  
 D More hydrogen atoms in the molecules results in stronger hydrogen bonding

11. A mixture of propanone (CH<sub>3</sub>COCH<sub>3</sub>) and cyclohexane (C<sub>6</sub>H<sub>12</sub>) forms a completely miscible liquid. The solution represents

- A An ideal mixture  
 B A mixture that deviates positively from Raoult's Law  
 C A mixture that deviates negatively from Raoult's Law  
 D An azeotropic mixture

12. The two nuclei in the hydrogen molecule are held together by

- A Mutual attraction between the nuclei.  
 B Van der Waals forces between the molecules.  
 C Electrostatic attraction between the nuclei and the shared electrons.  
 D Mutual sharing of the lone electron between the two hydrogen atoms.

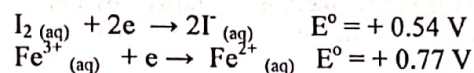
13. The pH of a 0.1 M solution of NaOH is

- A 10  
 B 12  
 C 11  
 D 13

14. A mixture of ammonia solution and ammonium chloride [NH<sub>3</sub>(aq)/NH<sub>4</sub>Cl(aq)] constitutes an alkaline buffer. Which one of the equations below represents the reaction of the buffer with a few drops of dilute acid?

- A NH<sub>4</sub><sup>+</sup>(aq) + OH<sup>-</sup>(aq) → NH<sub>3</sub>(aq) + H<sub>2</sub>O(l)  
 B H<sup>+</sup>(aq) + OH<sup>-</sup>(aq) → H<sub>2</sub>O(l)  
 C NH<sub>3</sub>(aq) + H<sup>+</sup>(aq) → NH<sub>4</sub><sup>+</sup>(aq)  
 D CH<sub>3</sub>COO<sup>-</sup>(aq) + H<sup>+</sup>(aq) → CH<sub>3</sub>COOH(aq)

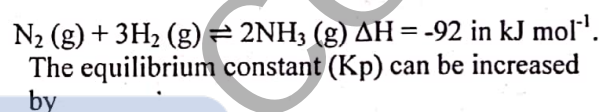
15. Given the standard reduction potentials for the following half reactions:



Which of the following statements is correct?

- A The strongest reducing species is Fe<sup>2+</sup>(aq)  
 B The strongest oxidizing species is I<sub>2</sub>(aq)  
 C The value of the cell electromotive force (E<sub>cell</sub>) is -0.23 V  
 D The overall cell reaction is  
 $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{aq})$

16. The equilibrium reaction:



- A Adding a catalyst to the reaction mixture  
 B Increasing the temperature of the reaction mixture and increasing the partial pressure of H<sub>2</sub>  
 C Increasing the total pressure on the gas mixture at low temperature.  
 D By liquefying the ammonia gas as soon as it is formed

17. In a reaction mixture, if the temperature is raised by 10°C, which of the following is most likely to occur?

- A Twice as many collisions take place.  
 B The activation energy is reduced by half.  
 C The overall enthalpy change doubles.  
 D The number of molecules with sufficient activation energy doubles

18. Consider the reaction: 2A + B → C.  
 The rate expression is given by Rate = k[A][B]<sup>2</sup>  
 This shows that

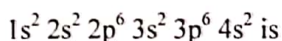
- A The rate of reaction will increase four times if the concentration of B is doubled.  
 B The reaction rate will increase if the temperature of the reaction is increased.  
 C The rate of reaction will remain the same if the concentration of A is doubled.  
 D The rate of reaction will double if the concentration of B is doubled.

Turn Over

19. For the Period Lithium to Neon, which of the following is a true statement?

- A The atomic volume decreases across the Period.
- B The atomic radius decreases from Li to N and then increases to Ne
- C The trend in boiling point is similar to melting point but values of melting points are higher.
- D Melting temperature increases from Li to C and then decreases to Ne due change in structure.

20. The element with electronic configuration



- A A transition metal.
- B An alkaline earth metal
- C An alkali metal
- D A noble gas

21. Which one of the following oxides is neutral?

- A  $\text{SiO}_2$
- B  $\text{BeO}$
- C  $\text{NO}$
- D  $\text{Al}_2\text{O}_3$

22. Magnesium differs from sodium in that

- A Magnesium hydroxide is insoluble in water while sodium hydroxide is soluble.
- B Only magnesium will react with steam.
- C Magnesium sulphate is insoluble in water while sodium sulphate is soluble
- D Magnesium carbonate is more stable to heat than sodium carbonate.

23. Redox reactions are common in the chemistry of Group VII elements (Halogens). Which statement is correct?

- A  $\text{Br}^-$  ions will reduce  $\text{Cl}_2$  but not  $\text{I}_2$ .
- B  $\text{Cl}_2$  will oxidise  $\text{Br}^-$  ions but not  $\text{I}^-$  ions.
- C  $\text{F}_2$  is the weakest oxidising agent out of  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$  and  $\text{I}_2$ .
- D  $\text{I}^-$  ions are the weakest reducing agents out of  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$  and  $\text{I}^-$ .

24. For Group IV elements

- A Inert pair effect is the reluctance of the outermost two electrons to take part in bonding.
- B Only carbon and tin exhibit allotropy. Silicon, germanium and lead exist only in one structural form.
- C The stability of the tetrachlorides increases down the group.
- D Only carbon undergoes catenation.

25. Copper is a transition element, with atomic number 29. Which one of the following statements is true?

- A The electronic configuration of copper is  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^2$ .
- B Its atomic radius is smaller than that of nickel with atomic number 28.
- C It does not exhibit variable oxidation states but forms complexes.
- D Copper (II) compounds are more stable in aqueous solution than copper (I) compounds

26. Which property of an atom does not affect its first ionisation energy?

- A the atomic radius
- B the number of electron shells
- C the number of neutrons
- D the number of protons

27. Copper forms the complex  $[\text{Cu}(\text{EDTA})]^{2-}$ . Which one of the following information is correct?

- A The oxidation state of copper is +2 and the coordination number of the complex is 6.
- B The oxidation state of copper is +2 and the coordination number of the complex is 1.
- C The oxidation state of copper is +1 and the coordination number of the complex is 6.
- D The oxidation state of copper is +1 and the coordination number of the complex is 1



28. 0.58 g of a volatile organic liquid when vaporized at 25°C and 1 atm, occupied a volume of 0.24 dm<sup>3</sup>. What is the molar mass of the liquid? ( $R = 0.082 \text{ atm dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$ ).

A 58.00  
B 59.05  
C 49.50  
D 54.09

29. An organic compound was fused with metallic sodium, plunged in water and the solution filtered. When a few drops of sodium nitroprusside were added to a portion of the filtrate in a test tube, a violet colouration was observed. This shows that the organic compound contains,

A Potassium  
B Nitrogen  
C Sulphur  
D A halogen

30. A sample of 2.30 g of ethanol was mixed with an excess of aqueous acidified potassium dichromate(VI) and refluxed to give ethanoic acid. If the yield of product was 60.0%, what mass of product was collected?

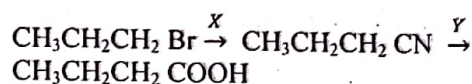
(Ethanol = 46, Ethanoic acid = 60)

A 1.32 g  
B 1.38 g  
C 3.00 g  
D 1.80 g

31. Which compound gives a positive test with alkaline aqueous iodine and does NOT show optical isomerism?

A  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{OH}$   
B  $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CHO}$   
C  $\text{CH}_3\text{COCH}(\text{OH})\text{CH}_3$   
D  $(\text{CH}_3)_2\text{C}(\text{OH})\text{CHO}$

32. X and Y are the reagents required to convert 1-bromopropane into butanoic acid.



What are the correct identities of X and Y?

	X	Y
A	$\text{NH}_3$	$\text{HCl (aq)}$
B	$\text{KCN in C}_2\text{H}_5\text{OH}$	$\text{NaOH(aq)}$
C	$\text{KCN in C}_2\text{H}_5\text{OH}$	$\text{HCl (aq)}$
D	$\text{HCN}$	$\text{NaOH(aq)}$

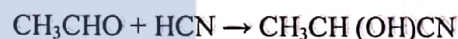
33. Which mixture could be used to produce propyl methanoate?

A  $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$  and  $\text{CH}_3\text{OH}$   
B  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  and  $\text{HCO}_2\text{H}$   
C  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  and  $\text{HCO}_2\text{H}$   
D  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$  and  $\text{CH}_3\text{OH}$

34. Which series shows molecules in order of increasing bond angle?

A  $\text{CH}_4 \rightarrow \text{BF}_3 \rightarrow \text{NH}_3$   
B  $\text{H}_2\text{O} \rightarrow \text{CO}_2 \rightarrow \text{BF}_3$   
C  $\text{NH}_3 \rightarrow \text{CH}_4 \rightarrow \text{CO}_2$   
D  $\text{NH}_3 \rightarrow \text{CH}_4 \rightarrow \text{H}_2\text{O}$

35. The reaction



is an example of

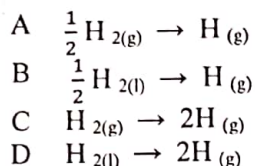
A Electrophilic addition reaction  
B Nucleophilic addition reaction  
C Free radical addition reaction  
D Rearrangement reaction

36. What is the accepted conventional name for the compound,  $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_3$

A 2,2-dimethylbutane  
B 1,1-dimethylbutane  
C 2,2-dimethylethane  
D Trimethylethane

Turn Over

37. Which equation has an enthalpy change of reaction which corresponds to the standard enthalpy change of atomisation of hydrogen?



**QUESTION 38 to 45 (Eight questions)**

**Directions:** For each of the questions below ONE or MORE of the responses is (are) correct. Decide which of the responses is (are) correct then choose

- A If 1, 2 and 3 are all correct  
 B If 1 and 2 only are correct  
 C If 2 and 3 only are correct  
 D If 3 only is correct

Directions			
summarised	A	B	C
	A	B	C
	1, 2 and 3 All Correct	1 and 2 Only Correct	2 and 3 Only Correct

38. Two solutions of aqueous hydrochloric acid were put into two different beakers, 1 and 2 respectively. Two different samples of magnesium were added to each of the beakers and the rate of production of hydrogen gas was measured. It was observed that the rate of the reaction in beaker 2 was greater than the rate of the reaction in beaker 1. What is the likely explanation of this observation?

- The reaction in beaker 1 has a higher activation energy than the reaction in beaker 2.
- The magnesium in beaker 1 is in larger pieces than the magnesium in beaker 2.
- The acid in beaker 2 is at a higher concentration than the acid in beaker 1.

A  
 B  
 C  
 D

39. Which of the following statements are correct for an atom?

- Atoms of all elements contain protons, neutrons and electrons.
- An atom is electrically neutral because it contains equal numbers of electrons and protons.
- The ionization energy of an atom is a direct measurement of the ease with which an atom can lose an electron.

A  
 B  
 C  
 D

40. Which statements about reversible reactions are correct?

- An increase in concentration of a reactant always increases the concentration of the product.
- An increase in temperature always increases the rate at which the equilibrium is established.
- Addition of a catalyst will increase the concentration of the product at equilibrium.

A  
 B  
 C  
 D

41. The halogenoalkanes listed below all react with  $\text{NaOH}_{(aq)}$ . Which compounds proceed mainly by an  $\text{S}_{\text{N}}1$  mechanism?

- 1-iodopropane
- 2-iodo-2-methylpropane
- 2-bromo-2-methylbutane

A  
 B  
 C  
 D

42. Which properties increase from magnesium to barium?

1. ionic radius of the cation  $M^{2+}$
2. screening of outermost electrons by inner shells
3. solubility of the hydroxides,  $M(OH)_2$ , in water

A  
B  
C  
D

43. The melting point of chlorine is lower than the melting point of iodine. Which statements help to explain this difference?

1. The covalent bonds between iodine atoms are stronger than the covalent bonds between chlorine atoms.
2. An iodine molecule is more polar than a chlorine molecule.
3. Iodine has more electrons than chlorine and so has stronger van der Waals' forces.

A  
B  
C  
D

44. In the Bronsted-Lowry theory of acid-base behaviour

1. Water can behave as both acid and base
2. The conjugate base of  $HSO_4^-$  is  $SO_4^{2-}$
3. The conjugate acid of  $NH_3$  is  $H_3O^+$

A  
B  
C  
D

45. Which of the following processes are likely to be exothermic?

1.  $O(g) + e \rightarrow O^-(g)$
2.  $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$
3.  $Na^+(g) + aq \rightarrow Na^+(aq)$

A  
B  
C  
D

Turn Over



## Question 46 to 50 (Five questions)

Directions: Each of the questions consists of a statement in the left-hand column followed by a second statement in the right-hand column. Decide whether the first statement is true or false. Decide whether the second statement is true or false. Then choose:

- A. If both statements are true and the second statement is a correct explanation of the first statement.
- B. If both statements are true and the second statement is NOT a correct explanation of the first statement.
- C. If the first statement is true but the second statement is false.

If the first statement is false but the second statement is true

DIRECTIONS SUMMARISED			
Option	FIRST STATEMENT	SECOND STATEMENT	
A	TRUE	TRUE	Second statement is a CORRECT explanation of the first statement
B	TRUE	TRUE	Second statement is NOT a CORRECT explanation of the first statement
C	TRUE	FALSE	
D	FALSE	TRUE	

	FIRST STATEMENT	SECOND STATEMENT
46	The melting point of carbon is lower than the other Group IV elements	Carbon forms gaseous oxides whereas the oxides of the other Group IV elements are solids
47	Phenylamine reacts with ice-cold nitrous acid liberating nitrogen and forming phenol	The $\text{NH}_2$ group attached to the benzene ring has an unshared electron pair hence Phenylamine acts as a base (proton acceptor).
48	The first electron affinity of sulphur is negative while the second electron affinity is positive	When bonds are formed energy is released but when bonds are broken energy is required
49	$\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ is a stronger acid than $\text{CH}_3\text{CO}_2\text{H}$	An alkyl group has an electron-releasing effect relative to a hydrogen atom.
50	The atomic radius of transition metals decreases gradually from scandium to copper	Nuclear charge increases from scandium to copper and the electrons entering an inner d-orbital have little screening effect.