GENERAL CERTIFICATE OF EDUCATION BOARD
General Certificate of Education Examination

0715 CHEMISTRY 1

JUNE 2023 **ADVANCED LEVEL**

Centre No.	
Centre Name	
Candidate Identification Number	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

One hour and a half (1H 30 minutes)

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.

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

Before the examination begins:

3. Check that this question booklet is headed "0715 CHEMISTRY 1 - Advanced Level"
4. Fill in the information required in the spaces above.
5. 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

6. Answer ALL the 50 questions in this Examination. All questions carry equal marks.
7. Non-programmable calculators are allowed.
8. Each question has FOUR suggested answers: A, B, C and D. Decide on which answer is correct. 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]
9. 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.
10. 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.
11. Do all rough work in this booklet, using, where necessary, the blank spaces in the question booklet.
12. **At the end of the examination, the invigilator shall collect first the answer sheet and then the question booklet after. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

Questions 1 - 36 (Thirty-six 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. Give the name of the instrument used to determine the structure of crystals.
   A Mass spectrometer
   B X-ray goniometer
   C UV spectrometer
   D IR spectrometer

2. Below are some properties of chlorine, bromine and their compounds. Which property has a smaller value for chlorine than bromine.
   A Bond strength of hydrogen-halogen bond
   B Strength of van der waals forces between molecules of the element
   C First ionisation energy
   D Solubility of the silver halide in aqueous ammonia

3. Given the following half equations
   $Cr^{3+}(aq) + e^- \leftrightharpoons Cr^{2+}(aq)$ $E^\theta = -0.41$ V
   $Cu^{2+}(aq) + 2e^- \leftrightharpoons Cu(s)$ $E^\theta = +0.34$ V
   Calculate the e.m.f of the cell formed when the two half cells are coupled.
   A +0.75 V
   B -0.07 V
   C +0.07 V
   D -0.75 V

4. The radioactive decay of $^{63}_{28}Ni$ has a half-life of 120 days. How long will it take for 1.2 g of nickel to reduce to 0.30 g?
   A 60 days
   B 120 days
   C 240 days
   D 360 days

5. Which reagent is used to distinguish between propan-1-ol and propan-2-ol?
   A PCi_5
   B Thionyl chloride
   C Ammoniacal silver nitrate
   D $ZnCl_2$/conc HCl

6. Which of the terms below permits the use of +4 oxidation state by group IV elements in the formation of compounds?
   A Inert pair effect
   B Catenation
   C Hybridization
   D Ionization

7. Identify the products formed when sodium nitrate, $NaNO_3$ is strongly heated.
   A $NaNO_2$, and O_2
   B Na_2O, NO_2 and O_2
   C Na_2O, and NO_2
   D $NaNO_2$, NO_2 and O_2

8. The reaction of benzene with bromine in the presence of iron(III) bromide is: -
   A Nucleophilic substitution
   B Electrophilic addition
   C Rearrangement and elimination
   D Electrophilic substitution

9. The reaction between two species C and D was investigated and the following data collected.

Experiment	[C] $moldm^{-3}$	[D] $/moldm^{-3}$	Initial rate/ $moldm^{-3}s^{-1}$
1	0.15	0.15	1
2	0.30	0.15	4
3	0.15	0.30	2

   The rate expression is given as
   A Rate = k [C][D]
   B Rate = k [C][D]^2
   C Rate = k [C]^2[D]
   D Rate = k [C]^2[D]^2

10. In the complex ion $[Cr(en)_2Cl_2]^+$, state the coordination number and oxidation state of chromium.
    A 4 and +1
    B 6 and +3
    C 6 and +1
    D 4 and +3

11. How many lone pairs of electrons are in a molecule of carbon monoxide (CO)?
    A 1
    B 2
    C 3
    D 4

12. An element X has the following successive ionization energies in kJ mol^{-1}
    786, 1580, 3230, 4360, 16000, 20000, 23600
    To which group in the Periodic Table does X belong?
    A group IV
    B group III
    C group II
    D group V

13. A sample of an organic compound was heated with sodium pellets and dissolved in water. A sample of the solution turned violet with prepared sodium nitroprusside. This indicates the element present in the sample is: -
A Nitrogen
B Sulphur
C Chlorine
D Bromine

14. Which of the following compounds is most readily hydrolysed?
A CH_3COOH
B $CH_3CO_2C_2H_5$
C CH_3CONH_2
D CH_3COCl

15. Calculate the concentration of chloride ions in a solution containing 100 cm^3 of a 0.1 M magnesium chloride, $MgCl_2$.
A 0.02
B 0.01
C 0.2
D 0.1

16. In the periodic table the elements down a group are arranged in order of
A Increasing atomic number
B Increasing electronegativity
C Increasing relative atomic mass
D Increasing density

17. For the reaction
$H_2(g) + F_2(g) \rightarrow 2HF(g)$
Calculate the enthalpy of formation of HF in kJ mol^{-1} given the following values of bond energies. E(H-H) = +436 $kJmol^{-1}$, E(F-F) = +158 kJ mol^{-1}, E(H-F) = +565 $kJmol^{-1}$
A +268
B -536
C +536
D -268

18. Which of the following is the strongest acid in aqueous solution?
A HIO_3
B HIO_4
C HIO_2
D HIO

19. The compound 2-methylpropan-1-ol is an example of: -
A a tertiary alcohol
B a secondary alcohol
C a primary alcohol
D an unsaturated alcohol

20. Find the pH of 0.02 M hydrochloric acid
A 2.0
B 2.7
C 1.7
D 1.0

21. Which of the following is an amphoteric oxide of period 2 of the periodic table?
A Al_2O_3
B Li_2O
C CO_2
D BeO

22. Ammonia is manufactured industrially by the Haber process. Which catalyst is used for the process?
A Vanadium(V)oxide
B Finely divided iron
C Platinum/Rhodium gauze
D Copper powder

23. Which of the following pair of oxides is acidic?
A CO and CO_2
B GeO_2 and PbO_2
C SiO_2 and PbO_2
D CO_2 and SiO_2

24. Give the name of the compound
$CH_3CO\text{-}NHCH_3$
A Acetyl ethanamide
B N-methylethanamide
C N-methylethanoate
D Acetyl methyl amine

25. What will be the coefficients of $Cr_2O_7^{2-}$ and Fe^{2+} respectively when the following redox equation is balanced?
$Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow Cr^{3+} + Fe^{3+} + H_2O$
A 1 and 6
B 1 and 2
C 3 and 6
D 3 and 2

26. When ethanal is warmed with Fehling's solution
A A silver mirror is formed
B A red precipitate is formed
C A white precipitate is formed
D A yellow precipitate is formed

27. The isolation of an optically active isomer from a racemic mixture is referred to as: -
A Configuration
B Distillation
C Enantiomers
D Resolution

28. 0.35 g of vanadium was reacted with 0.28 g of oxygen to form an oxide (V = 51, O = 16). The empirical formula of the oxide is: -
A V_2O_5
B V_2O_3
C VO_3
D VO_2

29. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ $\Delta H = +124\ kJ$
The numerical value of the equilibrium constant will increase if
A The total pressure is increased
B Temperature is reduced
C Temperature is increased
D The total pressure is reduced

30. Calculate the mass of sodium carbonate, Na_2CO_3 required to prepare 0.25 dm^3 of 0.1 M solution. (RAM: Na = 23; C = 12; O = 16)
A 0.265 g
B 2.075 g
C 0.2075 g
D 2.650 g

31. Which of the following compounds exhibits geometric isomerism?
A CH_2=CHCOOH
B CH_2=$CHCH_3$
C CH_2=$C(CH_3)$COOH
D HOOCCH=CHCOOH

32. Calculate the pH of a buffer solution made up of equal volumes of 0.1 $moldm^{-3}$ sodium propanoate and 0.04 mol dm^{-3} propanoic acid. ($Ka = 1.3 \times 10^{-5}$)
A 1.33
B 4.89
C 5.28
D 3.11

33. A compound with molecular formula C_6H_{12} on ozonolysis gives propanone, CH_3COCH_3 as the only product. Deduce the structural formula of the compound.
A CH_3CH=$C(CH_3)_2$
B $(CH_3)_2C$=$C(CH_3)_2$
C $CH_3C(C_2H_5)$=$CHCH_3$
D CH_3CH=$CHCH(CH_3)_2$

34. Which of the following compounds contains nitrogen in the oxidation state of -2?
A N_2H_4
B HNO_3
C HNO_2
D NO

35. What is the name of the complex ion $[Fe(OH)_2(H_2O)_4]^+$?
A Tetraaquadihydroxoiron(II)
B Tetraaquadihydroxoferrate(II)
C Tetraaquadihydroxoferrate(III)
D Tetraaquadihydroxoiron(III)

36. When a mixture of sodium benzoate, $C_6H_5COO^-Na^+$ and soda lime is heated the type of reaction that occurs is
A Decarboxylation
B Neutralization
C Substitution
D Condensation

Questions 37 - 45 (nine 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 Summarized			
A	**B**	**C**	**D**
1,2,3 correct	**1,2 only**	**2,3 only**	**3 only**

37. How can the rate of the reaction: $S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow H_2O(l) + S(s) + SO_2(aq)$ be followed?
1. Change of mass
2. Colourimetric analysis
3. Electrical conductivity
A
B
C
D

38. For the reaction: $C(s) + 1/2O_2(g) \rightarrow CO(g)$
The enthalpy change is:
1. Atomization
2. Combustion
3. Formation
A
B
C
D

39. Which of the following reactions will yield a carboxylic acid derivative?
    1. Action of warm concentrated ammonia on carboxylic acid.
    2. Heating two carboxylic acids at a high temperature in the presence of P_4O_{10}.
    3. Action of thionyl chloride ($SOCl_2$) on a carboxylic acid.

    A
    B
    C
    D

40. For a complex ion to be formed: -
    1. The ligand must have at least an electron donor atom.
    2. The central metal ion must have low lying empty orbitals.
    3. The central metal ion must have a charge greater than +2

    A
    B
    C
    D

41. Which of the following pairs of liquid will form a solution that will deviate negatively from Raoult's law?
    1. Ethanol and water
    2. Benzene and methanol
    3. Propanone and trichloromethane

    A
    B
    C
    D

42. Carbon differs from other elements of group IV in that:
    1. carbon forms only gaseous oxides.
    2. carbon catenates extensively.
    3. carbon lacks low-lying d orbitals.

    A
    B
    C
    D

43. Which of the following reagents could be used to distinguish between phenol and cyclohexanol?
    1. Neutral iron(III) chloride.
    2. Bromine water
    3. Phosphorus pentachloride

    A
    B
    C
    D

44. Lithium and magnesium resemble each other in that; their
    1. carbonates are decomposed by heat.
    2. nitrates decompose to oxides, nitrogen dioxide and oxygen on heating.
    3. ions give characteristic colours on a bunsen flame.

    A
    B
    C
    D

45. The bond(s) in lithium tetrahydridoaluminate(III), $LiAlH_4$ is/are
    1. Hydrogen bonding.
    2. Covalent bonding.
    3. Ionic bonding

    A
    B
    C
    D

Questions 46 - 50 (Five questions)

1) Directions: Each of the following 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.

D If the first statement is false, but the second statement is true.

Summary of Directions			
	First Statement	**Second Statement**	
A	**True**	**True**	**Second statement is a CORRECT explanation of the first**
B	**True**	**True**	**Second statement is NOT a CORRECT explanation of the first**
C	**True**	**False**	
D	**False**	**True**	

	FIRST STATEMENT	SECOND STATEMENT
46.	A mixture of ethanol and water cannot be completely separated by fractional distillation.	Ethanol and water form an azeotropic mixture
47.	When ethanol is heated with concentrated sulphuric acid at 170 ^{0}C the product is ethene	Concentrated sulphuric acid is an oxidizing agent.
48.	The hydrogen atom shows only one series of spectral lines	The hydrogen atom contains only one electron
49.	Phenylamine reacts with $NaNO_2$/ HCl at T < 10°C to form phenol liberating nitrogen	Phenylamine is an aromatic amine
50.	The first ionization energy of elements decreases down a group of the Periodic Table	Down the group the shielding effect by inner electrons decreases

GO BACK AND CHECK YOUR WORK