CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

CHEMISTRY

Paper 01 – General Proficiency

1 hour 15 minutes

09 JUNE 2023 (p.m.)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This test consists of 60 items. You will have 1 hour and 15 minutes to answer them.
2. In addition to this test booklet, you should have an answer sheet.
3. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
4. On your answer sheet, find the number which corresponds to your item and shade the space having the same letter as the answer you have chosen. Look at the sample item below.

Sample Item

The SI unit of length is the

(A) metre
(B) second
(C) newton
(D) kilogram

Sample Answer

● Ⓑ Ⓒ Ⓓ

The best answer to this item is "metre", so (A) has been shaded.

5. If you want to change your answer, erase it completely before you fill in your new choice.
6. When you are told to begin, turn the page and work as quickly and as carefully as you can. If you cannot answer an item, go on to the next one. You may return to that item later.
7. You may do any rough work in this booklet.
8. Figures are not necessarily drawn to scale.
9. You may use a silent, non-programmable calculator to answer items.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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1. Which of the following properties refer to an electron?

	Relative Charge	Approximate Mass
(A)	–1	0
(B)	0	1
(C)	0	2
(D)	+1	1

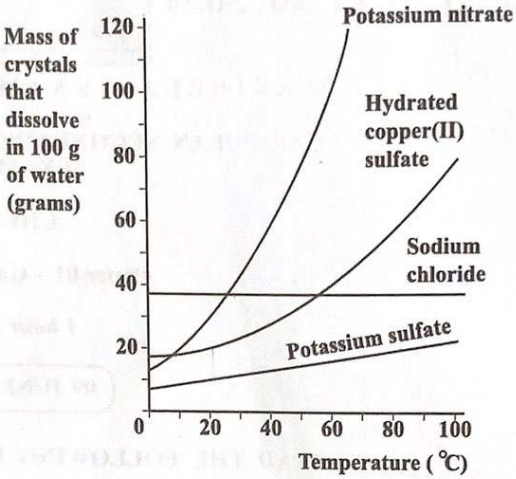
2. Which set of elements has atoms with two electrons in their outer shells?

(A) Period 2
(B) Group 2
(C) Group 7
(D) Period 3

3. The arrangement of electrons in atoms of X and Y are 2, 8, 5 and 2, 8, 6 respectively. Which of the following represents X and Y?

	X	Y
(A)	Metal	Non-metal
(B)	Non-metal	Non-metal
(C)	Non-metal	Metal
(D)	Metal	Metal

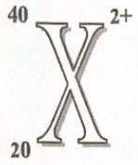
Item 4 refers to the solubility curves in the following diagram.



4. The salt with the greatest solubility at 20 °C is

(A) sodium chloride
(B) potassium nitrate
(C) potassium sulfate
(D) hydrated copper(II) sulfate

Item 5 refers to the following diagram in which X represents the symbol of a positive ion.



5. Which of the following pairs represents the number of neutrons and electrons in X?

	Number of Neutrons	Number of Electrons
(A)	60	20
(B)	60	18
(C)	20	20
(D)	20	18

Item 6 refers to the information in the following table.

Element	Number of Protons	Number of Electrons	Number of Neutrons
Q	8	8	8
R	16	16	16
S	8	8	9
T	16	18	16

6. Which of the following pairs of elements are isotopes?

(A) Q and S
(B) Q and R
(C) R and T
(D) S and T

7. One property of ionic compounds is that they

(A) contain molecules
(B) are solids and vaporize easily
(C) usually dissolve in organic solvents
(D) conduct electricity when molten or dissolved in water

8. The element that is used to determine the relative atomic mass of other elements is

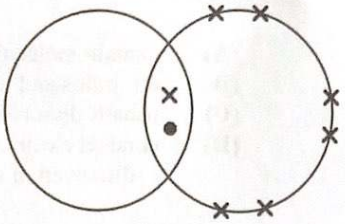
(A) carbon-10
(B) carbon-12
(C) carbon-13
(D) carbon-14

9. Which of the following terms describes calcium chloride?

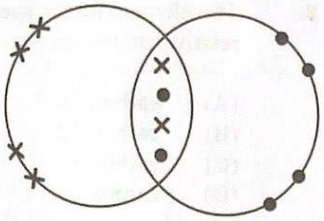
(A) Giant ionic structure
(B) Giant covalent structure
(C) Simple molecular crystal
(D) Macromolecular structure

10. Which of the following diagrams illustrates bonding in chlorine?

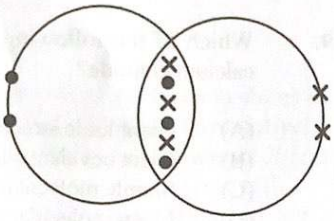
(A)



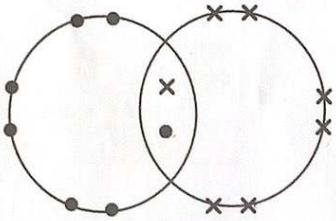
(B)



(C)



(D)



11. Which of the following substances can be described as the oxide of a metal?

(A) Alkali
(B) Base
(C) Salt
(D) Acid

12. The ionic equation for the reaction between an acid and a carbonate is represented by

(A) $2H^+(aq) + CO_3^{2-}(aq) \rightarrow HCO_3^-(aq)$

(B) $H^+(aq) + CO_3^{2-}(aq) \rightarrow H_2CO_3(aq)$

(C) $2H^+(aq) + CO_3^{2-}(aq) \rightarrow CO_2(g) + H_2O(1)$

(D) $H^+(aq) + CO_3^{2-}(aq) \rightarrow CO_2(g) + H_2O(1)$

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13. An atom has 20 electrons. When it ionizes, it has the same electronic configuration as

(A) argon
(B) neon
(C) sodium
(D) calcium

14. The mass concentration of a potassium chloride solution is 60 g dm^{-3}. What is the mass of potassium chloride in 25 cm^3 of this solution?

(A) 0.0015 g
(B) 0.15 g
(C) 1.5 g
(D) 15.0 g

15. A salt was heated with a certain base. The gas evolved and turned moist red litmus paper blue. Which of the following ions does the salt contain?

(A) Nitrate(V)
(B) Carbonate
(C) Sulfate(VI)
(D) Ammonium

16. Which of the following processes does NOT provide evidence in support of the particulate nature of matter?

(A) Osmosis
(B) Diffusion
(C) Filtration
(D) Brownian motion

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Item 17 refers to the reaction represented by the equation below.

$RCOOH(aq) + NaOH(aq) \rightarrow RCOONa(aq) + H_2O(l)$

17. Which of the following processes correctly describes the reaction above?

(A) Reduction
(B) Precipitation
(C) Neutralization
(D) Decomposition

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18. Which of the following statements is true?

(A) The particles in a gas are larger when heated.
(B) The particles in a gas are further apart when heated.
(C) The particles in a gas are very closely packed together.
(D) The particles in a gas have strong forces between them.

19. A solution having a pH of 1 will

(A) neutralize a solution of pH 4
(B) react with zinc metal to produce hydrogen
(C) react with zinc metal to produce a solution of pH 10
(D) react with hydrochloric acid to produce a salt and water

20. Which of the following is the correct formula for ammonium carbonate?

(A) NH_4CO_3

(B) $NH_4(CO_3)_2$

(C) $(NH_4)_2CO_3$

(D) $(NH_4)_2(CO_3)_2$

21. Barium is below calcium in Group II of the periodic table. When these two metals react with water, the main difference observed is the

(A) rate of reaction
(B) type of gas evolved
(C) colour of the product
(D) colour change with litmus

22. Which of the following elements exhibits allotropy?

(A) Silicon
(B) Carbon
(C) Uranium
(D) Aluminium

23. When a metal atom becomes an ion, it

(A) gains electrons and is oxidized
(B) gains electrons and is reduced
(C) loses electrons and is reduced
(D) loses electrons and is oxidized

24. A mixture of copper(II) oxide and copper(II) sulfate is BEST separated by

(A) distilling the mixture
(B) heating the mixture and condensing
(C) shaking with excess water and then filtering
(D) shaking with excess water followed by fractional distillation

25. Which of the following statements is true of an endothermic reaction?

(A) Heat is given up to the surroundings.
(B) Heat is absorbed from the surroundings.
(C) The products have less energy than the reactants.
(D) The products have the same energy as the reactants.

26. Which of the following factors will usually increase the rate of catalytic decomposition of hydrogen peroxide?

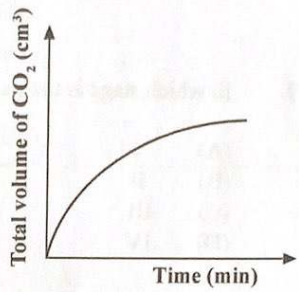
(A) Increasing the temperature
(B) Applying a greater external pressure
(C) Using a larger volume of hydrogen peroxide
(D) Using the catalyst in lumps rather than in powdered form

27. In which of the following substances will electrolysis NOT occur when an electrical current is passed through it?

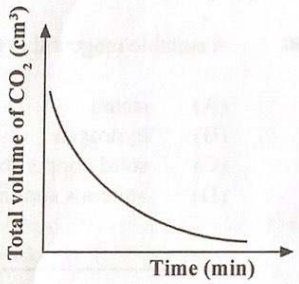
(A) Sodium hydroxide solution
(B) Molten sodium chloride
(C) Solid sodium chloride
(D) Dilute sulfuric acid

28. Some calcium carbonate was reacted with excess dilute hydrochloric acid. The volume of carbon dioxide evolved was recorded and plotted against time. Which of the following graphs represents this reaction?

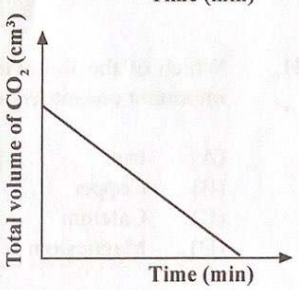
(A)



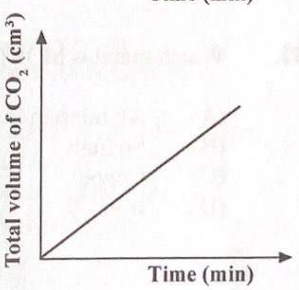
(B)



(C)



(D)



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Items 29 and 30 refer to the following sequence of reactions involving iron compounds, where I, II, III and IV represent progressive stages in the sequence.

$$FeCO_3 \xrightarrow{I} FeO \xrightarrow{II} Fe_2O_3 \xrightarrow{III} Fe_2(SO_4)_3 \xrightarrow{IV} Fe(OH)_3$$

29. In which stage is the oxidation state of iron increased?

(A) I
(B) II
(C) III
(D) IV

30. A suitable reagent that could be used at Stage IV is

(A) steam
(B) hydrogen
(C) solid copper oxide
(D) aqueous sodium hydroxide

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31. Which of the following substances is an important constituent of chlorophyll?

(A) Iron
(B) Copper
(C) Calcium
(D) Magnesium

32. Which metal is MOST easily ionized?

(A) Aluminium
(B) Sodium
(C) Copper
(D) Iron

33. Which metal is covered with a passive layer of oxide?

(A) Na
(B) Fe
(C) Cu
(D) Al

34. Which of the following observations is expected when aqueous silver nitrate is added to aqueous potassium chloride?

(A) A pungent gas is evolved.
(B) A blue precipitate appears.
(C) A white precipitate appears.
(D) A brown precipitate appears.

Item 35 refers to the following table which shows the reaction of four metals, W, X, Y and Z, with water or steam. The table also shows the products formed when nitrates of each metal are heated.

Metal	Reaction with Water or Steam	Products Formed When Nitrate is Heated
W	No reaction	Metal, NO_2 and O_2
X	Reacts with steam but not with cold water	Oxide, NO_2 and O_2
Y	Reacts rapidly with cold water	Nitrite and O_2
Z	Reacts slowly with cold water	Oxide, NO_2 and O_2

35. Which of the metals is likely to form a soluble hydroxide?

(A) W
(B) X
(C) Y
(D) Z

Item 36 refers to the following information.

A solution of iron(II) sulfate was added until in EXCESS to a solution of barium nitrate. The precipitate produced was filtered off and water was added to the residue in the filter paper.

36. The colour of the precipitate produced was

(A) yellow
(B) brown
(C) green
(D) white

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37. A suitable drying agent for the laboratory preparation of ammonia gas is

(A) calcium oxide
(B) calcium chloride
(C) anhydrous copper sulfate
(D) concentrated sulfuric acid

38. An element that is a non-metal

(A) is a solid at room temperature
(B) can act as a reducing agent
(C) forms an acidic oxide
(D) conducts electricity

39. In which of the following processes is sulfur used?

I. Vulcanization of rubber
II. Extraction of iron from iron ore
III. Manufacture of explosives

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

40. The main substances responsible for the production of 'acid rain' are

(A) chlorofluorocarbons
(B) lead compounds in exhaust fumes
(C) sulfur dioxide and sulfur trioxide
(D) carbon dioxide and carbon monoxide

Item 41 refers to the following table showing various tests and observations for gases.

	Test	Observation
(A)	Damp blue litmus paper	Damp blue litmus paper turns red.
(B)	Glowing splint	Splint relights.
(C)	Damp red litmus paper	Damp red litmus paper turns blue.
(D)	Lit splint	Splint extinguishes with a pop.

41. Which test can be used to identify an acidic gas?

42. Which of the following methods can be used in the extraction of aluminium?

(A) Reduction of the oxide by carbon
(B) Reduction of the oxide by hydrogen
(C) Electrolysis of the oxide in its molten state
(D) Displacement by a metal higher up the electrochemical series

43. Why is aluminium more resistant to corrosion than iron?

(A) Aluminium oxide formed is more reactive than iron oxide formed.
(B) Aluminium has reacted completely but iron has not reacted completely.
(C) Aluminium oxide does not react with aluminium but iron oxide reacts with iron.
(D) Aluminium oxide protects the aluminium but iron oxide does not protect the iron.

44. Which of the following reactions is LEAST likely to occur?

(A) $Fe(s) + Cu(NO_3)_2(aq) \rightarrow Fe(NO_3)_2(aq) + Cu(s)$

(B) $Pb(s) + Fe(NO_3)_2(aq) \rightarrow Pb(NO_3)_2(aq) + Fe(s)$

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

(D) $Mg(s) + Zn(NO_3)_2(aq) \rightarrow Mg(NO_3)_2(aq) + Zn(s)$

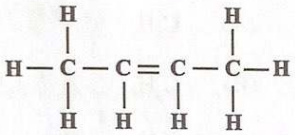
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45. Which of the following hydrocarbons is the MAJOR constituent of natural gas?

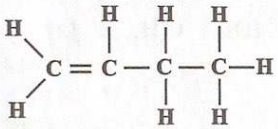
(A) Butane
(B) Ethane
(C) Propane
(D) Methane

46. Which of the following structures represents a molecule of but-2-ene?

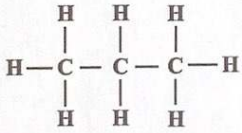
(A)



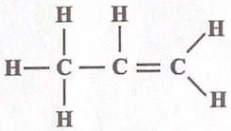
(B)



(C)



(D)



47. Which of the following substances is used as a monomer in addition polymerization?

(A) C_3H_7OH

(B) C_3H_6

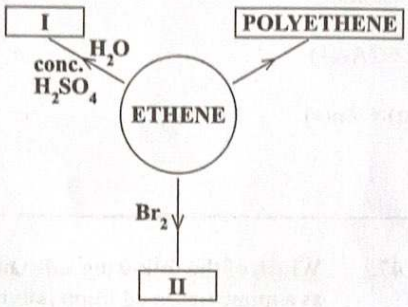
(C) C_3H_8

(D) $CH_3COOC_2H_5$

48. Which of the following reactions occurs between propene and bromine?

(A) Addition
(B) Substitution
(C) Precipitation
(D) Condensation

Item 49 refers to the following chart showing the conversion of ethene to different products.



49. The product, polyethene, is a

(A) gas
(B) solid
(C) liquid
(D) solution

50. An organic substance reacts with bromine water and decolourizes it immediately.

The substance is MOST likely an

(A) alcohol
(B) alkane
(C) alkene
(D) ester

51. Which of the following compounds will react with ethanoic acid to form an ester?

(A) CH_3CH_3

(B) CH_3CH_2Cl

(C) CH_3CH_2OH

(D) $CH_3CH_2CO_2H$

52. The compound which has the formula $CH_3CH = CHCH_2CH_2CH_3$ is

(A) an alkene
(B) a polymer
(C) a carboxylic acid
(D) an unsaturated acid

53. Which of the following statements is/are true of alkenes?

I. They react with $KMnO_4/H^+$.
II. They undergo addition reactions.
III. They undergo substitution reactions.

(A) I only
(B) I and II only
(C) I and III only
(D) I, II and III

54. Which of the following organic molecules has only two structural isomers?

(A) C_2H_6

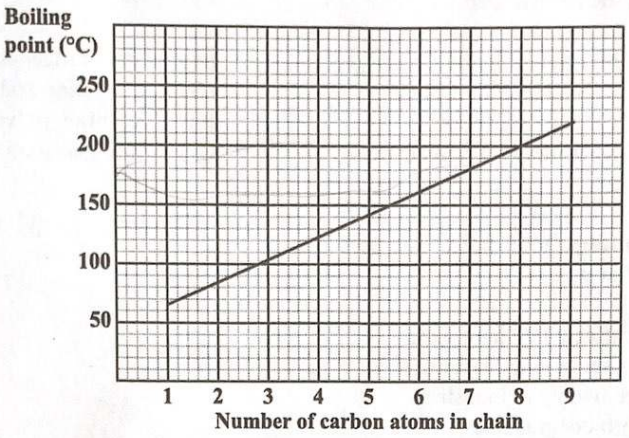
(B) C_3H_8

(C) C_4H_{10}

(D) C_6H_{12}

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Item 55 refers to the following graph which shows the boiling points of some straight-chain alcohols.



55. Which of the following molecular formulae represents the alcohol whose boiling point is 160 °C?

(A) $CH_3(CH_2)_3OH$

(B) $CH_3(CH_2)_4OH$

(C) $CH_3(CH_2)_5OH$

(D) $CH_3(CH_2)_6OH$

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56. Which of the following compounds can be dehydrated?

(A) Natural gas
(B) Propene
(C) Vinegar
(D) Ethanol

57. Hexane has the formula C_6H_{14}. Which of the following statements is true about hexane?

I. It is a covalent compound.
II. It is an unsaturated compound.
III. It belongs to a group of compounds known as alkanes.

(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

58. During the manufacture of ethanol by fermentation, the gas evolved

(A) turns lime water cloudy
(B) burns with a blue flame
(C) relights a glowing splint
(D) turns potassium dichromate green

59. The **disadvantage** of using a soapless detergent is that it

(A) is not affected by hard water
(B) causes scum with hard water
(C) is used widely in industries
(D) is non-biodegradable

60. Glucose is converted to starch or cellulose by

(A) dehydrogenation
(B) oxidation and reduction
(C) addition polymerization
(D) condensation polymerization

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.