

This paper consists of 2 sections. There are 30 questions in Section A and 20 questions in Section B.

Choose the best answer for each question.

Candidate may refer to the Periodic Table printed on page 16 when answering the questions.

Section A

1. Which of the following physical properties of oxygen and nitrogen is employed in its industrial separation process ?
 - A. density
 - B. viscosity
 - C. boiling point
 - D. miscibility with air

2. Which of the following concerning a $\text{N}\equiv\text{N}$ bond is INCORRECT ?
 - A. It has a total number of three electrons in the bond.
 - B. It is stable towards water at room temperature and pressure.
 - C. It is formed by sharing of three electrons by each nitrogen atom.
 - D. The density of electrons is higher relative to unbonded electrons.

3. The ionization of an acid in water involves the breaking of
 - A. an ionic bond.
 - B. a covalent bond.
 - C. intermolecular forces.
 - D. a metallic bond.

4. Which of the following substances is the hardest among all the others ?
 - A. chalk
 - B. marble
 - C. limestone
 - D. sodium metal

5. **X** is an element in the Periodic Table with an *A* number of 16. It reacts with **Y** to form a covalent compound Y_2X . How many outermost shell electrons does **Y** possess ?
 - A. 1
 - B. 2
 - C. 6
 - D. 7

6. Which of the following substances can be used to test for potassium chloride after mixing ?
- A. ammonia and magnesium nitrate
 - B. calcium chloride and sodium nitrate
 - C. silver nitrate and very dilute nitric acid
 - D. sodium hydroxide and copper(II) sulphate
7. In common practice, the oxidizing agent potassium permanganate is acidified with dilute sulphuric acid rather than hydrochloric acid since the latter
- A. decomposes more readily.
 - B. is more volatile relatively.
 - C. can function as an oxidizing agent.
 - D. reacts with potassium permanganate.
8. Which of the following has the highest expected pH value ?
- A. tap water
 - B. rain water
 - C. drain cleaner
 - D. window cleaner
9. Which of the following is / are NOT the advantage(s) of the use of perspex over glass ?
- (1) Perspex is lighter.
 - (2) Perspex has better light transmission.
 - (3) Perspex cannot be easily scratched.
- A. (1) only.
 - B. (2) only.
 - C. (1) and (3) only
 - D. (2) and (3) only
10. Consider the aqueous solution listed below:
- (1) phosphoric acid
 - (2) sulphuric acid
 - (3) hydrochloric acid
- Which of the following arranges the above acids in increasing order of basicity ?
- A. (1), (2), (3)
 - B. (2), (1), (3)
 - C. (3), (2), (1)
 - D. (2), (3), (1)

11. A plastic recycling coding is found on a plastic package of snack as shown:

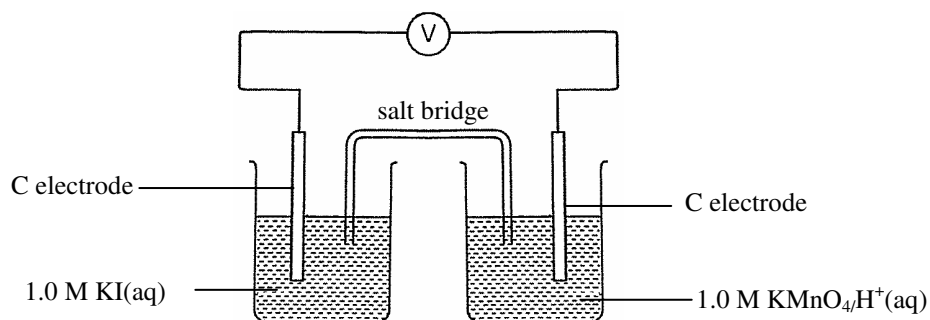


Which of the following statements concerning the plastic are correct ?

- (1) It can be recycled.
(2) It is an addition polymer.
(3) The systematic name of its monomer is propyl propenoate.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)
12. An oxide of lead, **X**, contains 90.6 % of lead by mass. What is mole ratio of lead to oxygen in **X** ?
- A. 1 : 1
B. 3 : 4
C. 4 : 5
D. 4 : 3
13. Which of the following could effectively reduce the emission level of nitrogen oxide pollutants in air when encouraged ?
- A. installation of scrubbers
B. application of unleaded petrol
C. installation of catalytic convertors
D. installation of electrostatic precipitators
14. Which of the following are NOT redox reactions ?
- (1) $\text{NaCl(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{NaNO}_3\text{(aq)} + \text{AgCl(s)}$
(2) $\text{H}_2\text{SO}_4\text{(aq)} + \text{NaNO}_3\text{(aq)} \rightarrow \text{NaHSO}_4\text{(aq)} + \text{HNO}_3\text{(aq)}$
(3) $\text{NaHCO}_3\text{(aq)} + \text{HCl(aq)} \rightarrow \text{H}_2\text{O(l)} + \text{CO}_2\text{(g)} + \text{NaCl(aq)}$
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

15. Which of the following can be used to prepare a sample of sulphur dioxide gas ?
- (1) heating copper turning with concentrated sulphuric acid
 - (2) mixing sodium sulphite with dilute hydrochloric acid
 - (3) heating iron pyrite (FeS_2) in air
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)
16. Which of the following ions have the same number of electrons as an argon atom ?
- (1) S^{2-}
 - (2) Ca^{2+}
 - (3) Cl^-
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)
17. Chromium (Cr) is a metal right below zinc in the reactivity series. Which of the following deductions is / are correct ?
- (1) It can be extracted from its ore by carbon reduction.
 - (2) It cannot displace magnesium from magnesium nitrate solution.
 - (3) It forms an oxide when heated in oxygen.
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only
18. Which of the following statements concerning common cleansing agent is / are correct ?
- (1) Oven cleaner removes greasy dirt by alkaline hydrolysis.
 - (2) Sodium hydrogensulphate can remove rust stains by neutralization.
 - (3) Toilet cleaner containing hydrochloric acid should not be mixed with household bleach.
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

19. Consider the following electrochemical cell:



Which of the following statements concerning the above electrochemical cell is / are correct ?

- (1) Potassium iodide turns from colourless to purple.
(2) Sodium nitrate is a possible reagent in preparation of the salt bridge.
(3) The electrons flow from KI(aq) to $\text{KMnO}_4/\text{H}^+(\text{aq})$ through the external circuit.
- A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only
20. Which of the following gases can be dried over concentrated sulphuric acid ?
- (1) nitrogen
(2) hydrogen
(3) hydrogen chloride
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)
21. Which of the following compounds will NOT be formed when ethene is treated with bromine in tetrachloromethane in the absence of light ?
- (1) 1,2-dibromoethane
(2) 1-bromoethane
(3) hydrogen bromide
- A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

22. Air pollutions can be relieved by encouraging the removal of
- A. carbon monoxide from diesel using scrubbers.
 - B. particulates from coal using electrostatic precipitators.
 - C. lead compounds from leaded petrol using catalytic converters.
 - D. nitrogen dioxide from heavy oil through increasing the air supply.
23. Which of the following statements concerning the electrochemical series is / are correct ?
- (1) The higher a substance sits in the series, the greater tendency to undergo oxidation.
 - (2) The lower a substance sits in the series, the more readily it accepts electrons.
 - (3) The higher a substance sits in the series, the stronger oxidizing power it possesses.
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only
24. Why is a nickel-cadmium cell rechargeable ?
- (1) Nickel is an oxidizing agent.
 - (2) No products are lost in the electrochemical process.
 - (3) The electrochemical process of functioning of the cell is reversible.
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only
25. Which of the following chemical changes has the greatest mole ratio of products to reactants when the process proceeds to completion assuming no limiting agents was involved ?
- A. dilution of H_2SO_4
 - B. cracking of C_8H_{18}
 - C. conversion of SO_2 to SO_3
 - D. reaction between H_2SO_4 and NaOH
26. Which of the following metals do(es) NOT react with dilute sulphuric acid ?
- (1) mercury
 - (2) iron
 - (3) copper
- A. (1) only
 - B. (2) only
 - C. (1) and (3) only
 - D. (2) and (3) only

27. Substance **J** has a melting point of 70°C and a boiling point of 140°C. When **J** dissolves in water, which of the following is the simplest way to separate **J** from water ?
- A. filtration
 - B. solvent extraction
 - C. fractional distillation
 - D. heating under reflux

Directions : Each question below (Questions Nos. 28-30) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a correct explanation of the first statement. Then select one option from A to D according to the following table:

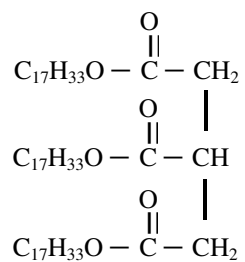
- A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
- B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
- C. The 1st statement is false but the 2nd statement is true.
- D. Both statements are false.

	1st statement	2nd statement
28.	The acidity of sulphuric acid is greater than that of ethanoic acid.	Sulphuric acid has a basicity higher than that of ethanoic acid.
29.	Ethene reacts with acidified potassium dichromate to form ethan-1,2-diol.	Acidified potassium dichromate is a strong oxidizing agent.
30.	Chlorine disproportionate in the dissolution with water.	Chlorine atom is oxidized and reduced simultaneously in the reaction with water.

END OF SECTION A

Section B

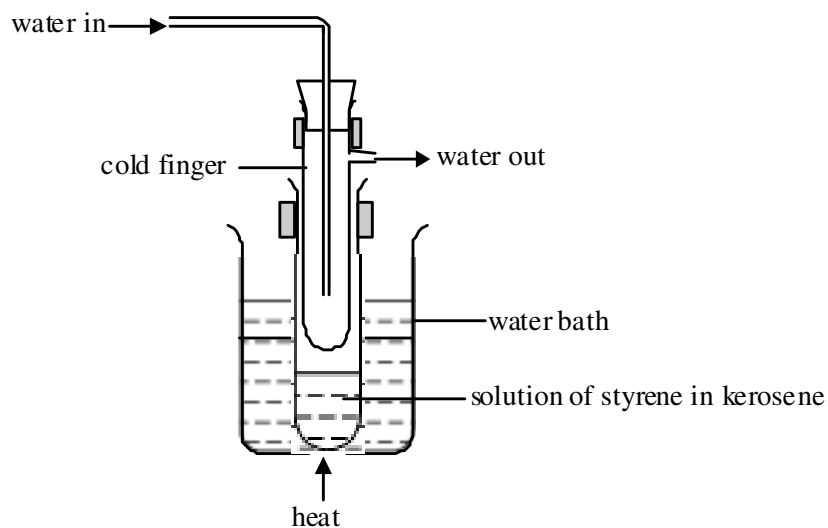
Directions: Question 31 and 32 refer to the following structures:



31. Which of the following statements concerning the molecule are correct ?
- (1) It is a branch-chain organic compound.
 - (2) It possesses three ester functional groups per molecule.
 - (3) It exists as solid state at room temperature and pressure.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)
32. The compound is treated with concentrated sodium hydroxide solution followed by concentrated sodium chloride solution. Which of the following statements are correct ?
- (1) A soapy detergent is formed.
 - (2) Saponification takes place in the experiment.
 - (3) Large scale discharge of the solution into river poses environmental harms.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)
33. The concentration of potassium ions and nitrate ions in a mixture of potassium carbonate and potassium nitrate are 0.5 M and 0.2 M respectively. What is the concentration of carbonate ions ?
- A. 0.10 M
B. 0.15 M
C. 0.20 M
D. 0.30 M

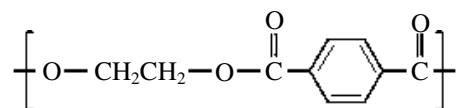
Directions: Question 34 and 35 refer to the following experiment.

A solution mixture of styrene and kerosene was brought to a set-up as shown below:



34. Which of the following statements concerning the experimental set-up are correct ?
- (1) The cold finger can condense vapour from the reaction mixture.
 - (2) The water bath can prevent a flammable organic liquid from overheated.
 - (3) The above experimental procedure can prevent the loss of volatile reactants.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)
35. Which of the following statements concerning the reaction that takes place in the above experiment are correct ?
- (1) Kerosene acts as a solvent.
 - (2) Styrene polymerizes to form an addition polymer.
 - (3) The resultant substance is stable towards thermal decomposition.
- A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

36. A polymer has the following repeating unit:

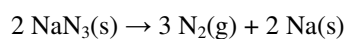


Which of the following statements concerning the polymer is / are correct ?

- (1) It is an addition polymer.
- (2) It deforms upon addition of concentrated sodium hydroxide.
- (3) Hydrogen chloride could be a side-product for its formation.

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

37. Nitrogen gas in automobile air bag can generated by the following:



What is mass of NaN_3 required to produce 70 dm^3 of N_2 ?

(Molar volume of gas at room temperature and pressure = 24 dm^3 ; Relative atomic mass of N = 14.0, Na = 23.0)

- A. 86.8 g
- B. 86.9 g
- C. 126.3 g
- D. 126.4 g

38. Which of the following aqueous solutions produce gaseous products as the *only* products upon electrolysis using carbon electrodes ?

- (1) silver nitrate
- (2) sodium hydroxide
- (3) potassium chloride

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

39. Which of the following is the strongest reducing agent ?

- A. zinc metal
- B. iron(II) nitrate solution
- C. sodium sulphite solution
- D. potassium iodide solution

40. In a titration experiment, 28.20 cm³ of 0.12 M H₂SO₄(aq) was required to attain the end-point with NH₃(aq). The molarity of the weak alkali is probably
- A. 0.13 M.
 - B. 0.14 M.
 - C. 0.27 M.
 - D. 0.28 M.
41. Which of the following substances can be used to dry a sample of carbon dioxide gas ?
- A. limewater
 - B. calcium oxide
 - C. sodium hydroxide
 - D. concentrated sulphuric acid
42. Which of the following apparatus are used to prepare a standard solution of sodium carbonate ?
- (1) pipette
 - (2) volumetric flask
 - (3) electronic balance
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)
43. A student treated two different metals respectively with excess acid solutions. If he would like to compare the relative reactivity of the metals by repeated observations of the initial rate of gas evolution, which of the following items should be held constant ?
- (1) mass of metals
 - (2) volume of acids
 - (3) concentration of acids
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)
44. When a piece of copper metal is treated with hot concentrated sulphuric acid, which of the following are the expected observable changes ?
- A. The solution turns blue and a gas which burns with a 'pop' sound evolved.
 - B. The solution turns yellow and a gas which burns with a 'pop' sound evolved.
 - C. The solution turns blue and a gas which turns limewater milky evolved.
 - D. The solution turns yellow and a gas which turns limewater milky evolved.

45. Which of the following can be used to distinguish carbon dioxide and sulphur dioxide ?

- (1) limewater
- (2) acidified potassium permanganate
- (3) acidified potassium dichromate

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

46. Which of the following products are derivatives of crude oil ?

- (1) town gas
- (2) soapy detergent
- (3) soapless detergent

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

47. Which of the following are the sources of nitrogen oxides in atmosphere ?

- (1) factories
- (2) incineration plants
- (3) power plants

- A. (1) only
- B. (2) only
- C. (1) and (3) only
- D. (2) and (3) only

Directions : Each question below (Questions Nos. 48-50) consists of two separate statements. Decide whether each of the two statements is true or false; if both are true, then decide whether or not the second statement is a correct explanation of the first statement. Then select one option from A to D according to the following table:

- A. Both statements are true and the 2nd statement is a correct explanation of the 1st statement.
- B. Both statements are true but the 2nd statement is NOT a correct explanation of the 1st statement.
- C. The 1st statement is false but the 2nd statement is true.
- D. Both statements are false.

	1st statement	2nd statement
48.	The progress of reaction between zinc and concentrated sulphuric acid can be monitored with a electronic balance.	The mass of reaction mixture of zinc and concentrated sulphuric acid decreases over time.
49.	The object to be electroplated should be attached to the cathode of the electrolytic cell.	In a process of electrolysis, a cation is reduced at the cathode.
50.	Lead and molten lead(II) bromide are electrolytes.	Lead and molten lead(II) bromide conduct electricity.

END OF PAPER

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PERIODIC TABLE 週期表

I		II												III	IV	V	VI	VII	0
3 Li 6.9	4 Be 9.0											5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2		
11 Na 23.0	12 Mg 24.3											13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.5	18 Ar 40.0		
19 K 39.1	20 Ca 40.1	21 Sc 45.0	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.8	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8		
37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3		
55 Cs 132.9	56 Ba 137.3	57 * La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)		
87 Fr (223)	88 Ra (226)	89 ** Ac (227)	104 Rf (261)	105 Db (262)															
		* 58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0				
		** 90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)				

atomic number 原子序

relative atomic mass 相對原子質量