Index Number: .....

Chemistry Olympiad Sri Lanka

Preliminary Selection Test – 2020

Answer ALL questions | Number of Pages 11 | Time: 2 hours + 30 minutes

Do not open the question paper until told to do so.

CODE: EBC

Composition 50 **Multiple Choice Questions**

a. Should indicate all your answers in the answer boxes provided on page 15.
b. Select the best answer for each question and mark a cross using a carbon pen as shown below.

17.	(a)	(b)	(c)	~~(d)~~	(e)

c. Mark only **one answer** to each question. (Marks will not be given for marking more than one answers.)
d. Clearly write your **index number** on top right hand corner of the booklet and **answer sheet**.

Calculators (scientific and normal) are allowed, but any other electronic devices (smart watches) are not allowed.

PERIODIC TABLE OF THE ELEMENTS

1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 **H** 1.008	2 2A																2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	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** 183.8	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)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (Uut) (284)	114 **Fl** (289)	115 (Uup) (288)	116 **Lv** (293)	117 (Uus) (294)	118 (Uuo) (294)

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** 231.0	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** (262)

Physical Constants

Gas Constant 8.314 J mol^{-1} K^{-1}	Avogadro Number 6.022×10^{23} mol^{-1}	0 °C = 273 K 1 atm = 760 mm Hg = 1.013 bar
Plank constant 6.6×10^{-34} m^2 kg s^{-1}	Standard temperature and pressure: 273 K and 100 kPa	

Choose the best answer out of the five choices

Use the information below to answer questions 1 and 2.

Hydrolysis reactions use water to breakdown large molecules like carbohydrates. Standard enthalpy and entropy change of hydrolysis of five disachcharides at 298 K are given in the table below. (Disaccharides composed of two molecules of simple sugars linked together.)

	ΔH^0 (kJmol^{-1})	ΔS^0 (Jmol^{-1}K^{-1})
Lactulose	2.2	49
Trehalose	4.7	57
Melibiose	-0.8	37
Cellebiose	-2.4	34
Arabinose	0.8	42

1. Which of the following disachcharide has the largest equilibrium constant for hydrolysis at 298 K according to the data given above?
   (a) Lactulose (b) Trehalose (c) Melibiose (d) Cellebiose (e) Arabinose

2. Hydrolysis breaks down Trehalose into to two glucose molecules. What should be the chemical formula of Trehalose?
   (a) $C_{12}H_{24}O_{12}$ (b) $C_{12}H_{22}O_{12}$ (c) $C_{11}H_{22}O_{12}$ (d) $C_{12}H_{22}O_{10}$ (e) None of these answers

3. Which of the following species contains three bond pairs and one lone pair around the central atom?
   (a) H_2O (b) BF_3 (c) NH_2^- (d) PO_4^{3-} (e) PCl_3

Use the information below to answer questions 4 and 5.

Nitrosyl chloride (NOCl) is a highly toxic gas and it decompose to NO and Cl_2 upon heating. Enthalpy change for formation of 1 mol of Cl_2 and 2 mol of NO during the decomposition of NOCl between 100 K and 600 K is 75 kJ/mol. Standard entropies of different species at 298 K are given below.

Species	NOCl	NO	Cl_2
S^0 J mol^{-1}K^{-1}	264	211	223

4. The equilibrium constant (Kp) of this reaction at 298 K is
   (a) 4.7×10^{-5} bar (b) 9.2×10^{-8} bar (c) 1.2×10^{6} bar (d) 7.4×10^{8} bar
   (e) Insufficient data to calculate

5. Consider the following statements related to the decomposition of NOCl
   (A) Kp of the reaction decrease with the temperature.
   (B) Entropy change of this reaction is always positive.
   (C) The reaction is spontaneous only above 300^0C.

   Which of the above statement/s is/are <u>false?</u>

   (a) Only A (b) Only B (c) Only C (d) Only A and C (e) All A, B and C

6. Metallic copper reacts with conc. nitric acid and produces $Cu(NO_3)_2$, NO_2 and H_2O. The variables given below as **a, b, c, d** and **e** represent the stoichiometric coefficients.

$$\boldsymbol{a}Cu_{(s)} + \boldsymbol{b}HNO_{3_{(aq)}} \rightarrow \boldsymbol{c}Cu(NO_3)_{2_{(aq)}} + \boldsymbol{d}NO_{2_{(g)}} + \boldsymbol{e}H_2O_{(aq)}$$

The respective values for the coefficient **a, b, c, d** and **e** are,

(a) 3, 8, 3, 2 and 4
(b) 4, 5, 3, 2 and 4
(c) 2, 4, 3, 2 and 4
(d) 2, 3, 8, 6 and 4
(e) 1, 4, 1, 2 and 2

7. A vessel with volume of 500 mL contains CO_2 and O_2 gasses at the pressure of 10 atm. Partial pressure of CO_2 is 7.5 atm. What could be the masses of CO_2 and O_2 in the mixture respectively are

(a) 7.2 g and 0.8 g (b) 6.6 g and 1.6 g (c) 6.0 g and 4.8 g (d) 32 g and 44 g (e) 7 g and 16 g

8. A 20.00 mL solution of 20% w/w dichloromethane was prepared by mixing pure dichloromethane liquid and water. What should be the volume ratio of dichloromethane and water? (density of dichloromethane is 1.33 g ml^{-1}.)

(a) 1 : 3.3 (b) 1 : 5.3 (c) 1 : 7.3 (d) 1 : 10.8 (e) Data is not enough for the calculation

9. Methanol water mixture having 40 % mole methanol was prepared for an experiment by mixing appropriate volume of methanol to 100 mL of water. What was the volume of methanol mixed? (Density of methanol is 0.8 g/cm^3)

(a) 30 mL (b) 45 mL (c) 94 mL (d) 148 mL (e) 213 mL

10. A potion of 50.00 mL of water at 35^{0}C was added to a portion of 50.00 mL water at 25^{0}C in a calorimeter and stirred well. Maximum (final) temperature was 28^{0}C. What is the heat capacity of calorimeter? Specific heat capacity of water is 4.2 J g^{-1} K^{-1}.

(a) 280 J K^{-1} (b) 380 J K^{-1} (c) 530 J K^{-1} (d) 2750 J K^{-1} (e) 5213 J K^{-1}

11. Which of the following reaction/s are entropically favorable?

A. Haber process (make ammonia from nitrogen and hydrogen)
B. Syn gas production (produce carbonmonoxide and hydrogen from reacting methane and carbondioxide)
C. Burning phosphorus in air

(a) Only A (b) Only B (c) Only C (d) Both A and B (e) All three

12. Following enthalpy data are given

Compound	Lattice enthalpy kJ mol^{-1}	Ion	Enthalpy of hydration kJ mol^{-1}
$M(OH)_2$	-2998	M^{2+}	-1926
$N(OH)_2$	-2506	N^{2+}	-1576
		OH^-	-460

Enthalpy of hydration is the heat change when one mole of gaseous ion dissolved in sufficient water to give infinitely dilute solution.

Which statement is correct?

(a) Both compounds dissolve in water.
(b) Both compounds form precipitates.
(c) Only $M(OH)_2$ dissolve in water.
(d) Only $N(OH)_2$ dissolve in water.
(e) Can not come to a conclusion about solubility of the two compounds based on above data.

Questions 13-14 are connected.

A sample of solid **M** that weighs 0.60 g, was combusted in an excess of oxygen in a bomb calorimeter, which initially contains 710.0 g of water at 25 °C. After the reaction was completed, the temperature was observed to be 27 °C, and 1.5144 g of CO_2 (g) and 0.2656 g of H_2O(l) were produced. Heat capacity of calorimeter is 3759 J K^{-1}. The standard enthalpy of formation of CO_2(g) and H_2O(l) at 25°C are –393.51 kJ mol^{-1} and -285.83 kJ mol^{-1}, respectively.

13. Molecular formula of **M** is
    (a) $C_6H_8O_2$ (b) $C_7H_6O_2$ (c) $C_8H_{14}O$ (d) $C_6H_9O_2$ (e) $C_5H_6O_2$

14. If the enthalpy change of the above reaction is -3080 kJmol^{-1} (not the correct answer) what is the standard enthalpy of formation of A?
    (a) 528 kJ mol^{-1} (b) 287 kJ mol^{-1} (c) -532 kJ mol^{-1} (d) -1028 kJ mol^{-1} (e) -2328 kJ mol^{-1}

15. If A represents the central atom, in which molecule is the X-A-X angle the smallest?
    (a) AlF_3 (b) SiF_4 (c) PF_3 (d) SF_2 (e) H_2O

16. Methanol is manufactured by the reaction of carbon monoxide gas with hydrogen gas. If a 95 % yield is usually obtained, approximately how many liters of hydrogen gas at 350 °C and 300 atm are usually required to make 1.0 liter of methanol measured at 20.0 °C. The density of methanol at 20.0 °C is 0.8 g/mL.
    (a) 0.89 L (b) 2.5 L (c) 4.8 L (d) 5.0 L (e) 8.1 L

17. Consider the following statements
    A. Lead has a stronger metallic character than Tin
    B. Tellurium has a higher melting point than Selenium
    C. Arsenic is more electronegative than Antimony
    D. Bismuth has a larger atomic radius than Lead
    Which of the above statements are correct?
    (a) Only A & B (b) Only B & C (c) Only A, B & C (d) All A, B, C, & D
    (e) none of the above

18. Each of the following atomic orbitals is possible except
    (a) 2p (b) 3d (c) 3f (d) 4d (e) 4f

19. Which has the second highest ionization potential?
    (a) Ge (b) As (c) Se (d) Br (e) Co

20. A palladium or platinum catalyst was used in an automobile to convert carbon monoxide gas to carbon dioxide according to the following reaction:

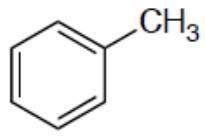
$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

    A chemist researching the effectiveness of a new catalyst combines a 2.0 : 1.0 mole ratio mixture of carbon monoxide and oxygen gas (respectively) over the catalyst in a 2.45 L flask at a total pressure of 745 torr and a temperature of 552 K. When the reaction is complete, the pressure in the flask has dropped to 552 torr. What percentage of the carbon monoxide was converted to carbon dioxide?
    (a) 67.7 % (b) 85.7 % (c) 77.5 % (d) 57.8 % (e) 46.5 %

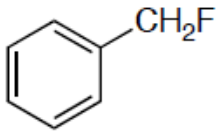
21. A mixture of CH_4(g) and C_2H_6(g) has a total pressure of 0.53 atm. Just enough O_2(g) is added to the mixture to bring about its complete combustion to CO_2(g) and H_2O(g). The total pressure of the two product gases found to be 2.12 atm. Assuming constant volume and temperature, find the mole fraction of CH_4 in the mixture.
    (a) 0.50 (b) 0.57 (c) 0.86 (d) 0.43 (e) 0.75

22. How many maximum different isomeric structures with the ketone functionality could be drawn for the molecular formula $C_6H_{12}O$?
(a) 3 (b) 4 (c) 5 (d) 6 (e) 7

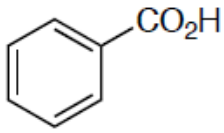
23. Arrange the following compounds in the order of increasing reactivity toward electrophilic aromatic substitution.



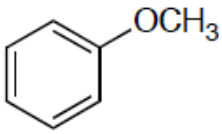
I



II



III



IV

(a) III, II, I, IV (b) II, III, IV, I (c) II, III, I, IV (d) III, I, IV, III (e) III, IV, I, II

24. A compound Y is treated with warm acidified potassium dichromate (VI). The resulting organic product gives an orange precipitate with 2,4-dinitrophenylhydrazine reagent but does not give a silver mirror with Tollen's reagent. What is Y?
(a) Butanal (b) 2-Methylpropanal (c) 2-Methylpropan-2-ol (d) Butan-1-ol (e) Butan-2-ol

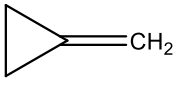
25. A gaseous mixture with volume 16.8 dm^3 contains two unsaturated neighboring hydrocarbons belong to same group. Density of the mixture was 14.4 times as hydrogen gas. What could be the two hydrocarbons?
(a) CH_4, C_2H_6 (b) C_2H_2, C_3H_4 (c) C_3H_4, C_4H_6 (d) C_3H_6, C_4H_9 (e) none of the above

26. 0.0005 moles of metal bromide were dissolved in water and 60.0 mL of 0.025 M silver nitrate solution was required to complete precipitation of silver bromide. The oxidation state of the metal ion in the metal bromide is.
(a) +1 (b) +2 (c) +3 (d) +4 (e) cannot be determined

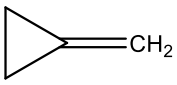
27. An organic compound of molecular formula C_4H_6 (**A**) forms a precipitate with ammonical silver nitrate and ammonical cuprous chloride. Isomer **B** of the compound **A** reacts with one mole of Br_2 to form 1,4-dibromo-2-butene. Isomer **C** of **A** reacts with Br_2 to produce a vicinal dibromide (vicinal – two atoms bonded to adjacent carbon). **A**, **B** and **C** are

(a) **A:** $CH_3—CH_2—C\equiv CH$ **B:** $CH_2=CH—CH=CH_2$; **C:** $CH_3—CH=C=CH_2$

(b) **A:** $CH_3—C\equiv C—CH_3$; **B:** $CH_3—CH=C=CH_2$; **C:** 

(c) **A:** 

; **B:**  ; **C:** $CH_2=CH—CH=CH_2$

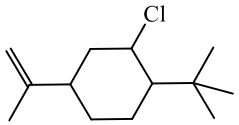
(d) **A:** $CH_3—CH_2—C\equiv CH$; **B:** $CH_3—C\equiv C—CH_3$; **C:** 

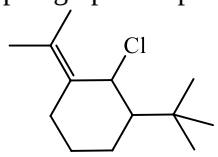
(e) **A:** $CH_3—CH_2—C\equiv CH$; **B:** $CH_2=CH—CH=CH_2$; **C:** 

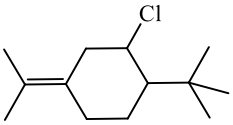
Answer questions 28-30 based on the following information given in the paragraph.

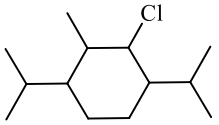
An organic compound **P** ($C_{13}H_{23}Cl$) exists as diastereomers and decolourize bromine water. **P** on treatment with ethanolic solution of KOH produces isomeric **Q** and **R** with molecular formula of $C_{13}H_{22}$. Treatment of either **Q** or **R** with Raney Nickel produces 4-isopropyl-1-tertiarybutylcyclohexane. **P** on oxidative ozonolysis gives acetone as one product.

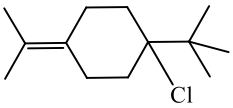
28. According to the information given in the above paragraph compound **P** is

(a) 

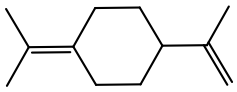
(b) 

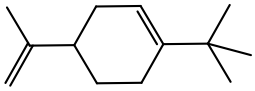
(c) 

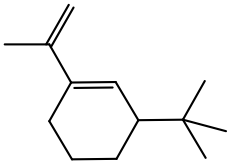
(d) 

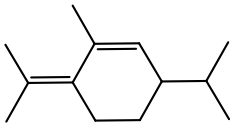
(e) 

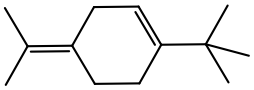
29. According to the information given in the above paragraph compound **Q** is

(a) 

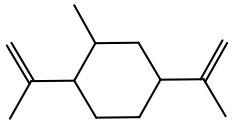
(b) 

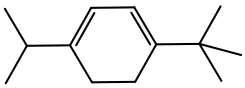
(c) 

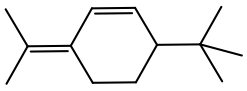
(d) 

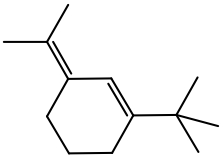
(e) 

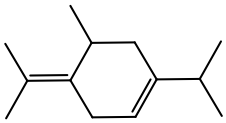
30. According to the information given in the above paragraph compound **R** is

(a) 

(b) 

(c) 

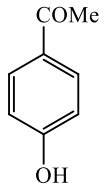
(d) 

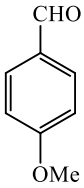
(e) 

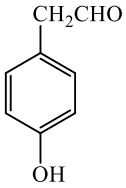
31. The electronic configurations of three elements, A, B and C are given below.
A - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
B - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
C - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$
The compound <u>not</u> possible to form is
(a) B_2 (b) AB_3 (c) C_3A_2 (d) CB_2 (e) C_2B

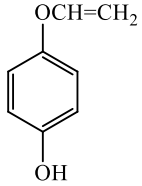
32. Five isomeric p-substituted aromatic compounds **A** to **E** with molecular formula $C_8H_8O_2$ are given for identification. Based on the following observations select the answer with the structures of the compounds **A** to **E**.

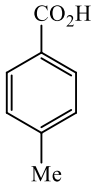
i. Both **A** and **B** form a silver mirror with Tollens reagent.
ii. **B** gives a positive test with neutral $FeCl_3$ solution.
iii. **C** gives positive iodoform test.
iv. **D** is readily extracted in aqueous $NaHCO_3$ solution.
v. **E** on acid hydrolysis gives 1,4-dihydroxy benzene.

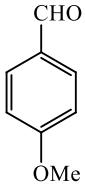
(a) **A:** 

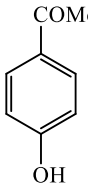
B: 

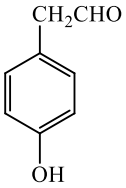
C: 

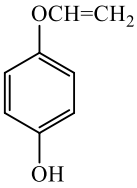
D: 

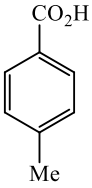
E: 

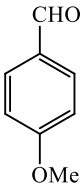
(b) **A:** 

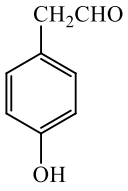
B: 

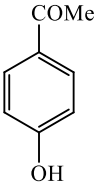
C: 

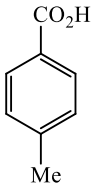
D: 

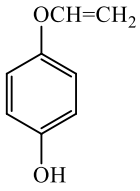
E: 

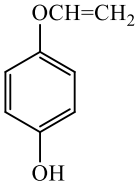
(c) **A:** 

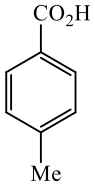
B: 

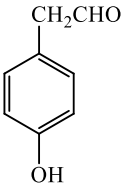
C: 

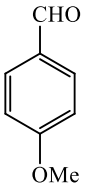
D: 

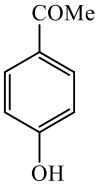
E: 

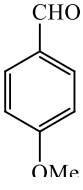
(d) **A:** 

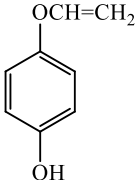
B: 

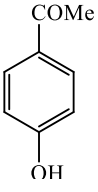
C: 

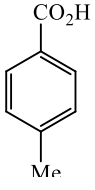
D: 

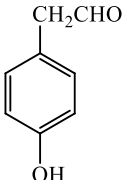
E: 

(e) **A:** 

B: 

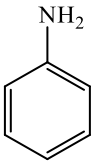
C: 

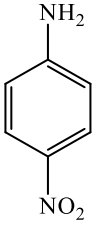
D: 

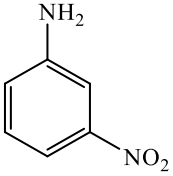
E: 

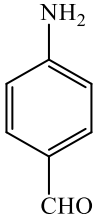
33. Phosphorous pentoxide (P_2O_5) is a chemical which is well known for its desiccation properties. Upon reacting with water, P_2O_5 gets converted to H_3PO_4. If a sample of P_2O_5 utilized for desiccation purposes underwent a total conversion to 196 g of H_3PO_4, what is the mass of water absorbed by the P_2O_5 sample?
(a) 44 g (b) 54 g (c) 64 g (d) 74 g (e) 84 g

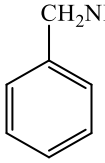
34. Among the following the strongest base is

(a) 

(b) 

(c) 

(d) 

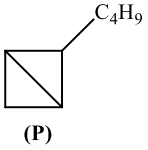
(e) 

35. The degree of unsaturation in a molecule can be calculated from its molecular formula using the following equation.
Degree of Unsaturation = (2C + 2 + N – X – H)/2

- C is the number of carbons
- N is the number of nitrogen
- X is the number of halogens (F, Cl, Br, I)
- H is the number of hydrogens

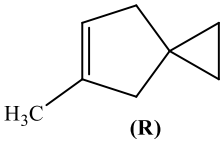
One degree of unsaturation is equivalent to one ring or one pi bond.

Using the above information, among the structures **P-T**, select the answer with the possible structures of a compound with the molecular formula C_8H_{12}.

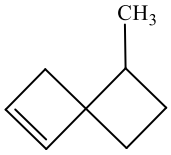


(P)

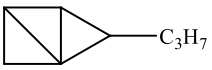

(Q)



(R)



(S)



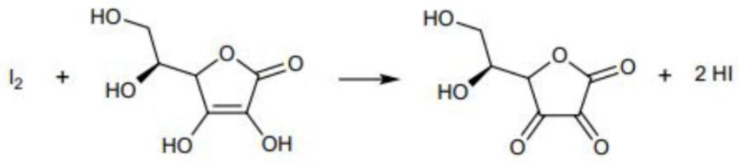
(T)

(a) P, R and S (b) P, R and T (c) Q, R and S (d) Q, R,S and T (e) All structures

36. A person applied following procedure for the determination of ascorbic acid (Vitamin C) in a sample solution. A volume of 20.00 cm^3 of the ascorbic acid sample was reacted with 25.00 cm^3 of 0.04 M KIO_3 solution and excess KI in acidic medium. The remaining I_2 is titrated against a 0.1 M $Na_2S_2O_3$ solution until the purple color of I_2 disappears. If the burette reading (volume of $Na_2S_2O_3$) is 40.00 cm^3 then what is the concentration of ascorbic acid in the sample solution? In the presence of Iodine (I_2), ascorbic acid gets oxidized to dehydroascorbic acid. Use the following equations to support your answer.

$$IO_{3\,(aq)}^{-} + 5I_{(aq)}^{-} + 6H_{aq}^{+} \rightarrow 3I_{2(l)} + 3H_2O$$

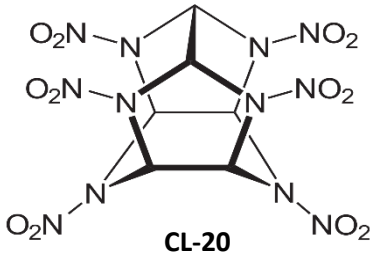
$$I_{2\,(g)} + 2S_2O_{3\,(aq)}^{2-} \rightarrow 2I_{(aq)}^{-} + S_4O_{6\,(aq)}^{-}$$



Ascorbic acid dehydroascorbic acid

(a) 0.10 M (b) 0.02 M (c) 0.025 M (d) 0.04 M (e) 0.05 M

37. Cyclic nitramine explosives such as RDX, HMX and CL-20 are the most commonly used class of explosives for construction and mining purposes. Formation of explosive products such as N_2 becomes the ultimate reason for the release of high amounts of energy, even with a very small amount of the explosive. In order to analyze the percentage purity of a CL-20 explosive sample, a person exploded a 0.05 g mass CL-20 explosive using an electrical detonation mechanism in an airtight container having a volume of 2.00 dm^3. After cooling down, N_2 formed inside the container due to the explosion was analyzed and its amount was found to be 0.0028 g. Calculate the percentage purity of the explosive sample assuming that the only detonation products formed are N_2, O_2 CO_2 and H_2O.

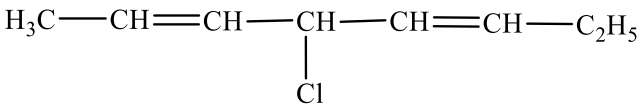


CL-20

(a) 11.6 % (b) 14.6 % (c) 87.6 % (d) 67.6 % (e) 23.6 %

38. Which combination produces colored gas at room temperature
    (a) Calcium hydride and water
    (b) Copper metal and conc. nitric acid
    (c) Sodium carbonate and sulfuric acid
    (d) Nitrogen gas and oxygen gas
    (e) None of the above

39. Total number of stereoisomers of the compound given below is



(a) 2 (b) 4 (c) 6 (d) 8 (e) 10

40. Ammonia borane in water can release hydrogen upon hydrolysis while forming NH_4BO_2 as the other product. The volume (cm^3) of hydrogen gas which will be evolved from the hydrolysis of 309 mg of ammonia borane (NH_3BH_3) with a purity of 90 % w/w at 27 °C and at atmospheric pressure 1.0 bar is approximately,
    (a) 66.5 cm^3 (b) 224.5 cm^3 (c) 673.4 cm^3 (d) 893.2 cm^3 (e) none of the above

41. Methylenedioxymethamphetamine (MDMA) is a psychoactive drug which can result in altered sensations and hallucinations as its main effect. The compound has C, H, N and O in the percentages of 68.39%, 7.77%, 7.25% and 16.58% by weight respectively. If the molar mass of this compound is 193 g/mol, what is the molecular formula of this compound?
    (a) $C_{11}H_{12}N_3O_3$ (b) $C_{12}H_{16}N_2O_3$ (c) $C_{13}H_{14}NO$ (d) $C_{11}H_{15}NO_2$ (e) $C_{12}H_{11}N_2O_2$

42. Which of the following among I-IV can exhibit Hydrogen bonding in their liquid state?
    I. CH_3OH II. CH_3NO_2 III. CH_3CN IV. CH_3NH_2
    (a) I only (b) I & III only (c) I & IV only (d) I, III & IV only (e) I, II, III and IV

43. What is the w/w percentage of nitrogen (N) in an ammonium nitrate solution with a density of 1.05 g/cm^3 and a molar concentration of 2.1 mol dm^{-3}?
    (a) 2.8 % (b) 11.2 % (c) 16.0 % (d) 5.6 % (e) 4.2 %

44. An organic compound **X** with molecular formula $C_8H_{16}O_2$ was hydrolyzed with dilute sulphuric acid to give **Y** and **Z**. Oxidation of **Z** with chromic acid produced **Y**. **Z** on dehydration gave 1-butene. What is the structure of **X**?

(a) $CH_3CH_2CH_2CH_2CH_2-C(=O)-OCH_2CH_3$

(b) $CH_3CH_2CH_2CH_2-C(=O)-OCH_2CH_2CH_3$

(c) $CH_3CH_2CH_2-C(=O)-OCH_2CH_2CH_2CH_3$

(d) $CH_3CH_2-C(=O)-OCH_2CH_2CH_2CH_2CH_3$

(e) $H_3C-C(=O)-OCH_2CH_2CH_2CH_2CH_2CH_3$

45. Consider the following statements about hydrogen bonds

(A) Maximum number of hydrogen bonds that a water molecule can have is 3.

(B) Hydrogen bonds in water break and form frequently

(C) Energy of a hydrogen bond is much greater than a covalent bond

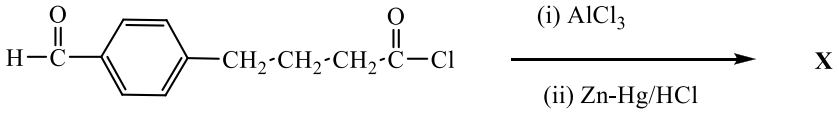
Which of the statements are correct

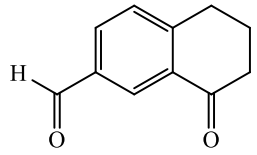
(a) Only A & B (b) Only B (c) Only B & C (d) Only A & C (e) A, B & C

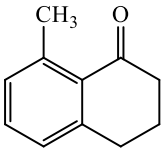
46. In allene (CH_2CCH_2), the type(s) of hybridization of the carbon atoms is (are)

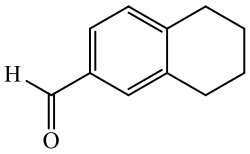
(a) sp and sp^3 (b) Only sp^2 (c) sp^2 and sp^3 (d) only sp^3 (e) sp and sp^2

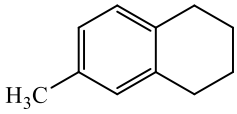
47. What would be the product **X** of the following reaction scheme?

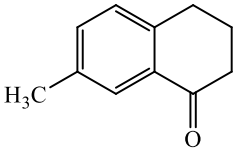


(a) 

(b) 

(c) 

(d) 

(e) 

48. Vibrational frequency (*f*) of a diatomic molecule is given by

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{\mu}}$$

where k is the force constant and μ is the reduced mass. For a diatomic molecule (AX), the reduce mass is given by

$$\mu = \frac{m_A m_x}{m_A + m_x}$$

where m_A and m_x are mass of atom A and atom B respectively.

If vibrational frequencies (in wavenumber terms) of Cl_2 and F_2 in are 915 cm^{-1} and 525 cm^{-1} respectively, what is the ratio between the corresponding force constants of Cl_2 and F_2 (Cl_2 : F_2)?

(a) 5.7 (b) 6.0 (c) 6.3 (d) 6.7 (e) 7.1

49. An old coin found in an ancient temple is composed of zinc coated with copper. In an experiment to find the percent zinc in the coin, a student determined the weight of the coin to be 3.0 g. Then the student made several scratches in the copper coating (to expose the underlying zinc) and put the scratched coin in hydrochloric acid, where the following reaction occurred between the zinc and HCl (copper remained undissolved):

$$Zn(s) + 2\ HCl\ (aq) \rightarrow H_2(g) + ZnCl_2\ (aq)$$

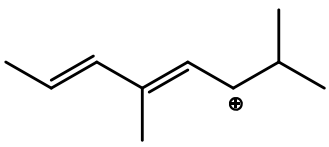
The student collected the hydrogen produced over water at 27 °C. The collected gas occupied a volume of 1 L at a total pressure of 1.02 bar. The percent zinc in the coin, the student found would be. (Assume that all the Zn in the coin dissolves.)

(a) 67.7 % (b) 98.2 % (c) 96.7 % (d) 88.3 % (e) 25.0 %

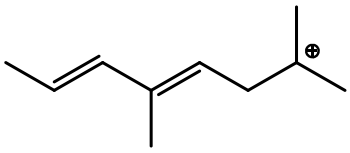
50. Which carbocation is the most stable?

(Hint: electron delocalization through resonance increases the stability of carbocations)

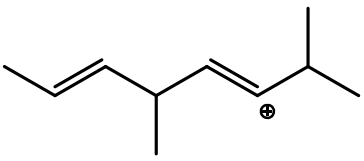
(a)



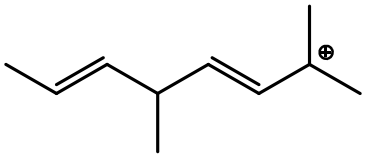
(b)



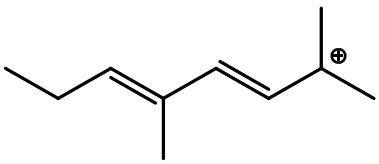
(c)



(d)



(e)



PAPER CODE - EBC

Index No …….

CHEMISTRY OLYMPIAD SRI LANKA PRILIMINARY EXAMINATION 2020

1.	(a)	(b)	(c)	(d)	(e)	28.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)	29.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)	30.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)	31.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)	32.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)	33.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)	34.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)	35.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)	36.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)	37.	(a)	(b)	(c)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(e)	38.	(a)	(b)	(c)	(d)	(e)
12.	(a)	(b)	(c)	(d)	(e)	39.	(a)	(b)	(c)	(d)	(e)
13.	(a)	(b)	(c)	(d)	(e)	40.	(a)	(b)	(c)	(d)	(e)
14.	(a)	(b)	(c)	(d)	(e)	41.	(a)	(b)	(c)	(d)	(e)
15.	(a)	(b)	(c)	(d)	(e)	42.	(a)	(b)	(c)	(d)	(e)
16.	(a)	(b)	(c)	(d)	(e)	43.	(a)	(b)	(c)	(d)	(e)
17.	(a)	(b)	(c)	(d)	(e)	44.	(a)	(b)	(c)	(d)	(e)
18.	(a)	(b)	(c)	(d)	(e)	45.	(a)	(b)	(c)	(d)	(e)
19.	(a)	(b)	(c)	(d)	(e)	46.	(a)	(b)	(c)	(d)	(e)
20.	(a)	(b)	(c)	(d)	(e)	47.	(a)	(b)	(c)	(d)	(e)
21.	(a)	(b)	(c)	(d)	(e)	48.	(a)	(b)	(c)	(d)	(e)
22.	(a)	(b)	(c)	(d)	(e)	49.	(a)	(b)	(c)	(d)	(e)
23.	(a)	(b)	(c)	(d)	(e)	50.	(a)	(b)	(c)	(d)	(e)
24.	(a)	(b)	(c)	(d)	(e)						
25.	(a)	(b)	(c)	(d)	(e)						
26.	(a)	(b)	(c)	(d)	(e)						
27.	(a)	(b)	(c)	(d)	(e)						