

B.SC. CHEMISTRY
SEMESTER-1ST (REPEAT)
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY
BSC-101

Duration: 3 Hrs.

Marks: 70

Part : A (Objective) = 20

Part : B (Descriptive) = 50

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins.

Marks: 50

[Answer question no. One (1) & any four (4) from the rest]

1. (a) What are the four quantum numbers? Explain the significance of four quantum numbers. 5+3+2=10
(b) A cricket ball weighing 100 g is to be located within 0.1 Å. What is the uncertainty in its velocity? Comment on your result.
(c) Explain Aufbau Principle using examples.

2. Write the postulates of kinetic theory of gases. Derive an expression for the pressure of an ideal gas by means of the kinetic theory of gases. Show that the total kinetic energy of the molecules in one mole of an ideal gas is equal to $\frac{3}{2}RT$. 6+4=10
Calculate the kinetic energy of two moles of N₂ at 27°C (R= 8.314 JK⁻¹mol⁻¹)

3. (a) A glass capillary of diameter 0.1 cm is dipped in water. Calculate the level of the water that rises in the capillary if surface tension of water = 72.75 dyne cm⁻¹, density = 0.9984 gcm⁻³. 3+3+4=10
(b) Explain the following terms
(i) Fluidity (ii) Surface tension
(c) Define viscosity of fluids and write its unit. How does the temperature affect the viscosity of a liquid?

4. (a) Define root mean square (RMS) and most probable velocity of gas molecules? 5+2+3=10
Explain how most probable velocities vary with temperature.
(b) State Pauli's exclusion principle with examples.
(c) State de Broglie principle and prove that $\lambda = \frac{h}{mv}$

5. (a) Suggests four similar reactions which justify diagonal relationship between Beryllium and Aluminium. 4+3+3=10

(b) Define electronegativity. How does it vary along periods and groups.

(c) On the basis of electronic configuration explain why-

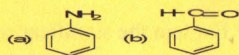
(i) Sulfur has lower electron affinity than Chlorine.

(ii) Sulfur has lower Ionization potential than phosphorous.

(iii) Boron has lower Ionization Potential than Beryllium.

6. (a) (i) Draw the orbital structure of the molecule, $H_2C=CH_2$. Evaluate the hybridization of C atoms; mention the bond angle and the geometry of the molecule. 3+4+3=10

(ii) Define resonance. What do you mean by resonance energy? Draw resonance structures for **any one** of the following molecules.



(iii) Explain the terms (any two)

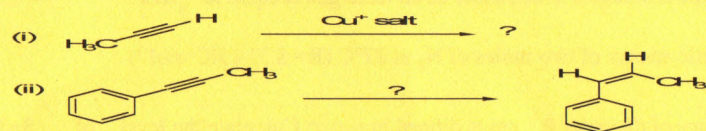
(a) Hyperconjugation.

(b) Intra-molecular Hydrogen bonding.

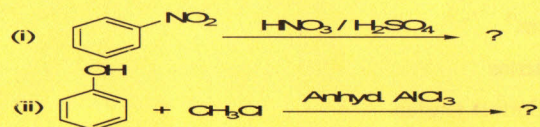
(c) Carbocations.

7. (a) Benzene contains three double bonds, however its experimental bond length is found in between single and double bond length. Explain why? 3+2+3+2=10

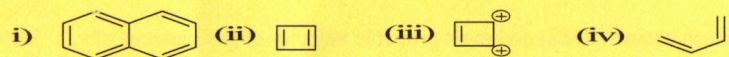
(b) Complete the following reaction-



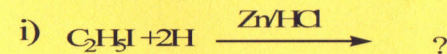
(c) Write the product of the following reaction-



(d) Identify compound based on aromatic, antiaromatic and non-aromatic character

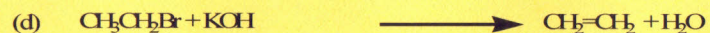
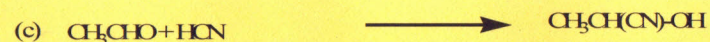
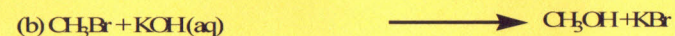
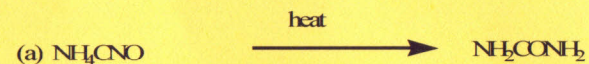


8. (a) Write the product of the following. 5x2=10



(b) Write the mechanism of Wurtz reaction.

(c) In which category the following reactions belong:



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B.S.C. CHEMISTRY
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BSC-101

[PART-A : Objective]

Choose the correct answer from the following :

1X20=20

- Which of the following statements is incorrect
 - The pressure exerted by the vapour in equilibrium with the liquid at affixed temperature is called vapour pressure.
 - the vapour pressure increases with rise in temperature
 - at equilibrium, liquid \rightleftharpoons vapour
 - at equilibrium, the rate of evaporation is not equal to rate of condensation
- The dimension in which coefficient of viscosity is expressed are
 - Mass X length X time
 - Mass X length
 - Mass X length
 - Mass
- With rise in temperature, the surface tension of the liquid
 - Increases
 - Decreases
 - Remains the same
 - None of the above
- The expressions for the root mean square and most probable velocities are respectively,-
 - $\sqrt{\frac{2RT}{M}}$, $\sqrt{\frac{3RT}{M}}$
 - $\sqrt{\frac{3RT}{M}}$, $\sqrt{\frac{2RT}{M}}$
 - $\sqrt{\frac{8RT}{M}}$, $\sqrt{\frac{2RT}{M}}$
 - $\sqrt{\frac{8RT}{\pi M}}$, $\sqrt{\frac{3RT}{M}}$
- The correct ratio is
 - $\langle C^2 \rangle^{1/2} : \langle C \rangle : C_p :: \sqrt{3} : \frac{\sqrt{8}}{\pi} : \sqrt{2}$
 - $\langle C^2 \rangle^{1/2} : \langle C \rangle : C_p :: \sqrt{2} : \frac{\sqrt{8}}{\pi} : \sqrt{3}$
 - $\langle C^2 \rangle^{1/2} : \langle C \rangle : C_p :: \sqrt{8} : \frac{\sqrt{3}}{\pi} : \sqrt{2}$
 - $\langle C^2 \rangle^{1/2} : \langle C \rangle : C_p :: \sqrt{3} : \frac{\sqrt{2}}{\pi} : \sqrt{8}$
- The mathematical expression for Heisenberg's Uncertainty principle is
 - $\Delta x \times \Delta P_x \leq \frac{h}{4\pi}$
 - $\Delta x \times \Delta P_x \geq \frac{h}{4\pi}$
 - $\Delta x \times \Delta V_x \geq \frac{h}{4\pi}$
 - None of the above
- The relationship for de Broglie equation is
 - $\lambda = \frac{h}{m}$
 - $\lambda = \frac{h}{p}$
 - $v = \frac{c}{\lambda}$
 - $\lambda = \frac{h}{v}$
- The order of increasing energy for the orbital-
 - $3s < 3p < 4s < 3d$,
 - $3s < 3p < 4s < 3d$,
 - $3s < 4s < 3p < 3d$
 - $3p < 3s < 3d < 4s$
- In which of the following orbital Hund's rule is not applicable-
 - p-orbital
 - d-orbital
 - f-orbital
 - s-orbital
- The position of Platinum (78) in the periodic table is-
 - Group 8th and period 6th
 - Group 9th and period 6th
 - Group 10th and period 6th
 - Group 10th and period 5th
- If Nb and Ta belong to the group 5th and period 5th and 6th respectively, the covalent radii of Nb will be -
 - greater than covalent radii of Ta
 - less than covalent radii of Ta
 - equal to covalent radii of Ta
 - twice the covalent radii of Ta
- The effective nuclear charge of 3d electron in Nickel is-
 - 7.55
 - 4.05
 - 5.05
 - 8.55
- Hybridisation of C in $^+CH_3$ is
 - sp³
 - sp²
 - sp
 - d²sp³

14. Which of these molecules, CCl_4 , CHCl_3 , CO_2 , H_2O , will have positive dipole moment

- CHCl_3 & CO_2
- CCl_4 only
- CCl_4 & CO_2
- CHCl_3 & H_2O

15. Which of the following molecule will have the highest boiling point

- C_4H_{10}
- $\text{C}_3\text{H}_7\text{NH}_2$
- $\text{C}_3\text{H}_7\text{OH}$
- $\text{CH}_3\text{-O-C}_2\text{H}_5$

16. The IUPAC name of the following compound is $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_2\text{OH}$

- Pent-3-en-1-ol
- Pent-2-ene-1,4-diyne
- Oct-6-ene-1,4-diyne
- None of the above




17. When Grignard reagent ($\text{CH}_3\text{CH}_2\text{MgBr}$) reacts with H_2O , the major product is

- CH_4
- C_2H_6
- $\text{Mg}(\text{OH})\text{Br}$
- ROH

18. Which of the following statement about carbocation is **not** correct?

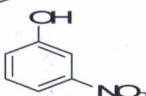
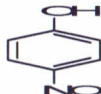

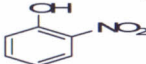
- Bridgehead carbocation is stable because of their non-planarity
- A carbocation would be stable if and only if it is planar.
- Possibility of resonance can increase the stability of carbocation
- In carbocation the carbon atom is sp^2 hybridized

19. Among the following compound which one is **not** aromatic-?

- 
- 
- 
- All the above

20. The product of the following transformation is-



- 
- 
- 
- 

UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA



[PART (A) : OBJECTIVE]

Duration : 20 Minutes

Serial no. of the
main Answer sheet

Course :

Semester : Roll No :

Enrollment No : Course code :

Course Title :

Session : 2017-18 Date :

Instructions / Guidelines

- The paper contains twenty (20) / ten (10) questions.
- Students shall tick (✓) the correct answer.
- No marks shall be given for overwrite / erasing.
- Students have to submit the Objective Part (Part-A) to the invigilator just after completion of the allotted time from the starting of examination.

Full Marks	Marks Obtained
20	

Scrutinizer's Signature

Examiner's Signature

Invigilator's Signature