

**B.SC. PHYSICS**  
**SEMESTER-1<sup>ST</sup>**  
**ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY**  
**BSC-711**

**Duration: 3 Hrs.**

**Marks: 70**

**Part : A (Objective) = 20**

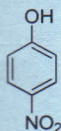
**Part : B (Descriptive) = 50**

**Duration: 2 Hrs. 40 Mins.**

**Marks: 50**

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

1. i. Discuss the important objectives of Bohr's theory. 4+3+3=10  
ii. Write down all the resonating structures of 4-nitrophenol.



4-nitrophenol

iii. Using the expression for the Maxwell distribution of velocities, draw the distribution at three different temperatures and comment on the shapes of the distribution curves.

2. i. Explain the absorption spectra from Bohr model of Hydrogen atom. 4+3+3=10  
ii. What is intermolecular and intramolecular hydrogen bonding? Explain with examples.  
iii. State the basic postulates of the kinetic theory of gases.
3. i. Calculate the energy associated with the 2<sup>nd</sup> orbit of He<sup>+</sup>. What is the radius of this orbit? 5+5=10  
ii. Discuss Heisenberg's Uncertainty principle and mention its significance.
4. i. Describe atomic radius and explain why cations are smaller and anions are larger in radii than their parent atoms? 5+5=10  
ii. Define electronegativity and explain the variation in electronegativity of elements along a period and in a group.

5. i. What is electronegativity? Among the following three compounds which one is ionic, which one is having polar covalent bond and which one is having non-polar covalent bond? 6+2+2=10

(a)  $\text{H}_2\text{O}$ , (b)  $\text{CH}_4$  (c)  $\text{NaCl}$ ,

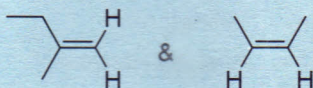
The electronegativity of the atoms are given as follows

$\text{H} = 2.1$ ,  $\text{C} = 2.5$ ,  $\text{O} = 3.5$ ,  $\text{Cl} = 3.0$ , and  $\text{Na} = 0.9$ .

ii. Between water ( $\text{H}_2\text{O}$ ) and diethyl ether ( $\text{Et}_2\text{O}$ ), which will have higher boiling point? Explain.

iii. What is the criteria of a molecule to be polar? Explain with example.

6. i. Which of the following will be more stable? Explain. 2+5+3=10



ii. What is Baeyer's strain theory on cycloalkanes? Discuss the stability order of following cycloalkanes according to the theory and write the corrected order of stability.

cyclopropane, cyclobutane, cyclopentane and cyclohexane

iii. How the following transformation can be achieved? Explain.



7. i. What is an equation of state? Deduce the following gas laws from the kinetic gas equation: 2+5=7

a. Boyle's law

b. Charle's law

ii. Give the physical significance of gas constant R 3

8. i. State Maxwell's law for the distribution of speeds among molecules of a gas. 2+2=4  
How does change in T and P affects this distribution.

ii. Following the Maxwell distribution of molecular speeds derive the expression for 3+3=6

a. average KE

b. root mean square speed

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**[ PART-A : Objective ]**

**Choose the correct answer from the following:**

**1X20=20**

- Dual behavior of matter was proposed by
  - Einstein
  - Bohr
  - de Broglie
  - Schrodinger
- Electron density of atomic orbitals can be given by
  - $\Psi^2$
  - $\Psi$
  - $2\Psi$
  - $\hat{H}\Psi$
- Heisenberg uncertainty principle predicts
  - The energy of the orbitals
  - Probability of finding the electrons
  - Wavelength of the emitted radiations
  - Size of atomic orbitals
- In which of the following orbitals electrons will be filled up first
  - 4p
  - 4s
  - 3d
  - 4f
- The general electronic configuration of halogens is
  - $ns^2np^3$
  - $ns^2np^6$
  - $ns^2np^5$
  - $ns^2np^1$
- Which of the following bond will be the most weakest
  - Ionic bond
  - Covalent bond
  - van der Waal bond
  - Metallic bond
- Which of the following atoms will have the highest ionization enthalpy
  - C
  - N
  - O
  - B
- Stability order of carbocation is
  - $1^\circ > 2^\circ > 3^\circ$
  - $3^\circ > 2^\circ > 1^\circ$
  - $2^\circ > 1^\circ > 3^\circ$
  - $3^\circ > 1^\circ > 2^\circ$
- The -OMe group shows
  - Only +I effect
  - Only -I effect
  - +I & + R- effect
  - I & + R- effect
- According to Bronsted-Lowry theory, a base
  - donates electron pair
  - accepts proton ( $H^+$  ion)
  - reacts with Lewis acid
  - produces hydroxide ( $OH^-$ ) ion in aqueous medium
- Which is the strongest Lewis base among the following
  - $H_2O_2$
  - HF
  - $NH_3$
  - $H_2O$
- An example of a non-polar solvent is
  - $Me_2CO$  (Acetone)
  - $H_2O$  (water)
  - MeOH (methanol)
  - $C_6H_{14}$  (Hexane)
- Which one of the following has inter molecular hydrogen bonding?
  - $P_2O_5$
  - $H_2S$
  - $PH_3$
  - $H_2O$
- Inductive effect is transmitted through
  - pi-bonds
  - sigma bonds
  - both the pi & sigma bonds
  - None of them

15. In defining Charle's law quantity which remains constant is  
 a. volume  
 b. pressure  
 c. temperature  
 d. forces
16. In Boyle's law the constant of proportionality K would be equal to  
 a. PT  
 b. PV  
 c. P/V  
 d. P/T
17. In kinetic gas equation of gases velocities of all molecules are not equal so we use  
 a. Square of velocity  
 b. Mean square velocity  
 c. Under root of velocity  
 d. Cube of velocity
18. On what factor does the average kinetic energy of gas molecules depend?  
 a. nature of the gas  
 b. temperature  
 c. volume  
 d. mass
19. Molar gas constant has the value  
 a.  $7 \text{ J mol}^{-1} \text{ K}^{-1}$   
 b.  $8 \text{ J mol}^{-1} \text{ K}^{-1}$   
 c.  $8.31 \text{ J mol}^{-1} \text{ K}^{-1}$   
 d.  $5 \text{ J mol}^{-1} \text{ K}^{-1}$
20. The perfect example of an ideal gas is  
 a. air  
 b. hydrogen  
 c. Water vapor  
 d. None of the above

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# UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA



**[PART (A) : OBJECTIVE]**

Duration : 20 Minutes

Serial no. of the  
main Answer sheet

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Course : .....

Semester : ..... Roll No : .....

Enrollment No : ..... Course code : .....

Course Title : .....

Session : ..... 2017-18 ..... Date : .....

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**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

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Invigilator's Signature