

GROUP - C

3. a) Write a short note on anomalous Zeeman effect 4

Or

Calculate the de Broglie wavelength of a bullet ($m=2 \times 10^{-3}$ kg) moving with a speed of 450 m/s. Write the electronic configuration of Xe and Zn^{2+} . 4

- b) Find the ground state term symbols for ${}_5B$ and ${}_{28}Ni$. 2
- c) Starting from the equation $\psi = A \sin(2\pi x / \lambda)$, arrive at the Schrödinger equation, $H\psi = E\psi$. 4
- d) Calculate the shortest wavelength of the absorption spectrum of deuterium ($R = 109737 \text{ cm}^{-1}$). 2
- e) Calculate the exchange energy for d^4 and d^5 configuration and hence comment on their stability. 2
- f) Write the angular part of the wave function of $d_{x^2-y^2}$ orbital of H atom. Hence draw the shape of it. 2

Or

The normal ionisation potential of hydrogen atom is 21.79×10^{-19} J. What will be the value of the ionisation potential when the electron is raised to the 2s level? 2

FIRST B. SC. EXAMINATION, 2017

(1st Semester)

CHEMISTRY (SUBSIDIARY)

PAPER - IS

Time : Two hours

Full Marks : 50

Use a separate answerscript for each group.

GROUP - A

1. a) State two experimental evidences from which we can conclude that no gas behaves ideally at moderate temperature and pressure. 3
- b) Using the relation $PV = \frac{1}{3} mnc^2$ with usual significance of the terms, prove that the mean kinetic energy of gas molecules is directly proportional to its absolute temperature for an ideal gas. 2
- c) What is meant by reduced equation of state? Deduce the same for a gas obeying van der Waal's equation. What is the importance of such an equation? 2+4+1
- d) Near critical temperature, a gas does not follow the van der Waal gas equation – Explain or criticize. 2
- e) For carbon dioxide $T_c=300^\circ K$ and its critical density is 0.45 gm/c.c. Calculate van der Waal's constants 'a' and 'b'. 3

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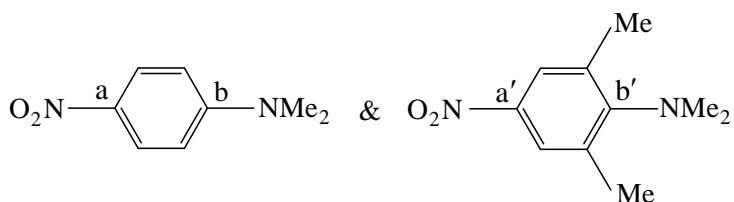
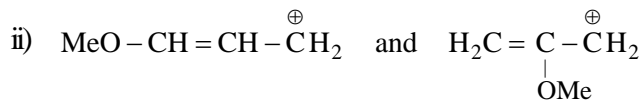
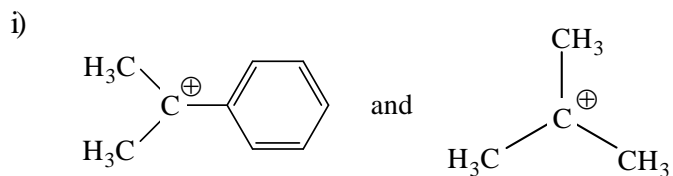
[2]

GROUP - B2. a) Answer **any two** of the following questions : $2\frac{1}{2}\times 2$

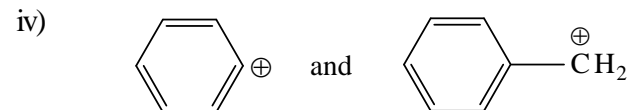
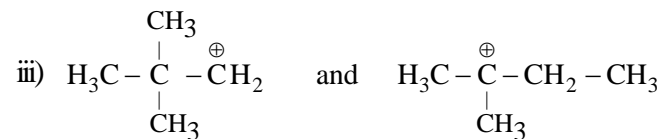
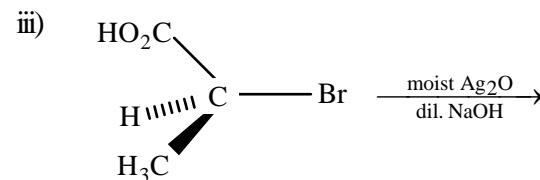
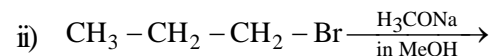
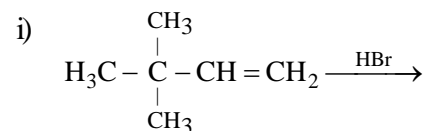
i) Between chloroform and dichloromethane which has higher dipole moment and why ?

ii) Explain why the first pK_a of $HO_2C-CH_2-CO_2H$ is much lower than CH_3CO_2H .

iii) Compare the C – N bond lengths (a vs. a') and (b vs. b') in the following compounds :

b) Comment on the relative stabilities of the following pairs of carbocations (answer **any two**) $2\frac{1}{2}\times 2$ 

[3]

c) Account for the observation that in dimethyl sulfoxide (DMSO) the order of reactivity of halide ions with methyl bromide is $F^{\ominus} > Cl^{\ominus} > Br^{\ominus} > I^{\ominus}$ which is opposite to that observed in methanol solution. 3d) Predict the plausible product(s) of the following reactions: (answer **any two**) 2x2

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