Sem []

## Subject: Chemistry PI Physical Chemistry. 2016-17

QP Code: 77149

(2½ Hours)

(1)

[ Total Marks :75

N.B.: (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Use of logarithmic table/non programmable calculator is allowed. Physical constants:

 $N = 6.022 \times 10^{+23}$  $k = 1.38 \times 10^{-23} JK^{-1}$ F = 96500 coulombs  $R = 8.314 \text{Jmo} \Gamma^{-1} \text{K}^{-1}$  $h = 6.624 \times 10^{-34} J.s$  $c = 3.0 \times 10^8 \text{ ms}^{-1}$  $\pi = 3.142$ 2.303 RT -=0.05916 at 298K. 1 amu = 93 1MeV. Mass of electron =  $9.109 \times 10^{-31}$ kg

1. Attempt any three of the following:-

- (A) Explain the term dipole moment and discuss the structure of
  - BF, and NH, molecules
  - Cis and trans isomers (b)

on the basis of their dipole moment

(B) Describe the effect of presence of isotopes on the rotational spectra leading to 5 the deformed spectra.

(C) What is zero point energy?

Calculate zero point energy, if the vibrational frequency of a molecule is  $3 \times 10^5 \,\mathrm{m}^{-1}$ .

- (D) For an anharmonic oscillator show that the frequencies of fundamental band, first 5 overtone and second overtone are in the ratio 1:2:3. 5
- (E) Explain the terms:-
  - Stoke's lines (i)
  - Anti-stokes lines (ii)
  - rule of mutual exclusion
- (F) Define force constant and state it's significance. Calculate force constant, if 5 is 1.2×10<sup>-27</sup> kg. vibrational frequency of a diatomic molecule is 1.0×10<sup>14</sup> s<sup>-1</sup> and reduced mass

TURN OVER

5



(4)	
2. Attempt any three of the following:  (A) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (A) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (b) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (c) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (a) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (b) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (c) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (d) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (e) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (e) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (e) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (e) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (e) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter  (f) Explain the concept of wave particle duality. Derive de-Broglie equation for matter for matter for matter for matter for matter for m	5
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2. Attempt any three of the following:  (A) Explain the concept of wave particle duality. Derive de la language	15
2. Attempt any three of the following.  (A) Explain the concept of wave particle duality. Describe the phenomenon of (a) Black body radiation (b) Compton effect. Why  (C) State schrondiger's time independent wave equation (b) Compton effect. Why  (D) Describe the phenomenon of (a) Black body radiation?	-
(A) Explain the concept of wave partial (B) Explain the concept of wave equation and explain the terms involved.  (B) State postulates of quantum mechanics.  (C) State schrondiger's time independent wave equation and explain the terms involved.  (C) State schrondiger's time independent wave equation and explain the terms involved.  (D) Describe the phenomenon of (a) Black body radiation (b) Compton effect. Why explain the terms involved.  (D) Describe the phenomenon of (a) Black body radiation (b) Compton effect. Why explain the terms involved.	-
(A) Explain the mechanics. wation and explain and effect. Why	5
waves.	100
(B) State postulates of time independent plack body radiate	5
(c) State schrondigers the menon of (a) Black mechanics?	5
Describe the phenomenod by classical method its experiment	3
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they can he decomposition potential	
<ul> <li>(B) State postulates of quantity (C) State schrondiger's time independent wave (C) State schrondiger's time independent by classical mechanics?</li> <li>(D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation?</li> <li>(E) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon of (a) Black body radiation (D) Describe the phenomenon (</li></ul>	
(E) Define overvoltage.  (F) Define overvoltage of H.SO <sub>4</sub> , the overvoltage of overvoltage.	
In the electrolysis of the eight times, what	
density is increased by organization	
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rag of sillcoll south	5
f the following:	
(b= 0.12V at 298K)  3. Attempt any three of the following:  (A) What are solar cells? Describe the construction and working of silicon solar cell.  (B) State any five advantages of hydrogen as universal energy medium.  (B) State any five advantages in NMR', while ethanol has 3 peaks'.	5
(A) What are solar cells, bear of hydrogen as unit ethanol has 3 peaks.	5
(B) State any five advantages of NMR, while comin and spin-lattice relationship	
(B) State of the anol has 2 peaks and Explain spile spile	
(C) Explain in the relaxation in Nivit.	5
D) III COLLEGE	5
(C) Explain methanol and MR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation in NMR? Explain (D) What is meant by relaxation (D) What is meant by rela	
(E) State important assumption of unimportant assumption (E) state important assumption (E)	
processes.  (E) State important assumptions, merits and drawbacks  (F) Discuss the Lindemann's theory for unimplecular reactions.	1
4. Attempt any three of the following:-  (A) Describe principle and working of CM. counter, with the help of labelled diagram.  (A) Describe principle and working of CM. counter, with the help of labelled diagram.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (A) Describe principle and working of CM. counter, with the help of labelled diagram.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (A) Describe principle and working of CM. counter, with the help of labelled diagram.  (B) Discuss the Lindendard.  (B) Discuss the Lindendard.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (C) Discuss the Lindendard.  (C) Discuss the Lindendard.  (C) Discuss the Lindendard.  (A) Describe principle and working of CM. counter, with the help of labelled diagram.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (C) Discuss the Lindendard.  (A) Discuss the Lindendard.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (B) Discuss the Lindendard.  (B) Discuss the Lindendard.  (C) Discuss the Lindendard.  (D)	5
4. Attempt any three of the following:-  4. Attempt any three of the following of CM. counter, with the help of labelled diagram.	
4. Attempt any times of and working of C.M. country,	5
(A) Describe principle and the state of the half life is 7.2×10 years.	5
(A) Describe principle and working of CM. counter, with a coun	300
(B) Calculate one minimum note on radioactive equilibrian	
(C) Write an informative heavilibrium,	5
radioactive and chemical countries of value and E <sub>Th</sub> for following reactions	
(C) Write an informative hold radioactive and chemical equilibrium.  radioactive and chemical equilibrium.  (D) Define threshold energy. Calculate Q value and E <sub>Th</sub> for following reaction.	
(D) Define threshold each $^{14}N + ^{4}He = ^{17}O + ^{14}He = 4.0034 \text{ amu}$ $m_N = 14.00 \text{ amu}, m_He = 4.0072 \text{ amu}$	
$^{14}N + ^{4}He = ^{17}O + H$	
$m = 14.00 \text{ amu}$ , $m_{He} = 4.0034 \text{ amu}$	
$m_N = 14.00$ and, $m_H = 1.0072$ amu $m_O = 17.0021$ amu, $m_H = 1.0072$ amu	-
m <sub>0</sub> = 17.0021 and the morking of different components	5
$m_0 = 17.0021$ amu, $m_H = 1.0072$ amu (E) With the help of schematic diagram, describe working of different components	
of nuclear power reactor.	5
of nuclear power reactor.  (F) How are radioisotopes used as tracers in chemical analysis? Explain their use in	
(F) How are radioisolopes used as master of following reactions.	
the determination of mechanism of tone	
Hydrolysis of esters (b) photosynthesis	
/x,	
Hydrolysis of esters (b) photosynthesis	0
[ TURN OVER	
2A	

	3 QP Code: 77149
1	State True or False:-
2)	(a) Homonuclear molecules are microwave active.  (b) The minimum value of rotational energy is one.  (c) p-dinitrobenzene has zero dipole moment.  (d) Rotational constant is also called as Bjerrum's constant.  OR  Fill in the blank with appropriate choice.  (p) Rotational constant is to moment of inertia.  (i) directly proportional  (ii) inversely proportional  (q) For, Rayleigh scattering,  (i) v <sub>s</sub> < v <sub>i</sub> (ii) v <sub>s</sub> = v <sub>i</sub>
	(b) The minimum value of rotational energy is one.
	(c) p-dinitrobenzene has zero dipole moment.
	(d) Rotational constant is also called as Bjerrum's constant.
	OR
A)	Fill in the blank with appropriate choice.
	(p) Rotational constant is to moment of inertia.
	(i) directly proportional (ii) equal (iii) inversely proportional
	(q) For, Rayleigh scattering,
	(i) $\overline{v_s} < \overline{v_i}$ (ii) $\overline{v_s} = \overline{v_i}$
	$(1)  \mathbf{v}_{\mathbf{s}} < \mathbf{v}_{\mathbf{i}} \qquad \qquad (11)  \mathbf{v}_{\mathbf{s}} = \mathbf{v}_{\mathbf{i}}$
	$(III)$ $V_s > V_i$
	(r) For a molecule to be Raman active, there must be a change in on absorption
	(i) frequency (ii) polarizability
	(iii) dipole moment (s) For a non-linear molecule, the total number of modes of vibration are given by
	(i) 3n-4 (ii) 3n-5
	(iii) 3n-6
(B)	<ul> <li>(i) 3n-4</li> <li>(ii) 3n-5</li> <li>(iii) 3n-6</li> <li>Fill in the blank with appropriate choice.</li> <li>(a) The wave function (Ψ) must be valued.</li> <li>(i) single</li> <li>(ii) double</li> </ul>
	(a) The wave function (Ψ) must be valued.  (ii) double
	(i) single
	(iii) infinite
	(iii) infinite (b) If $\hat{A}\hat{B}$ $f(x) = \hat{B}\hat{A}$ $f(x)$ , then the two operators $\hat{A}$ and $\hat{B}$ are said to be
	operators. (ii) commutative
	(i) linear
	(iii) additive involves producing a thin coating of metal on given surface by
	electrodeposition. (ii) electroplating
	(iii) electrophoresis  (iii) electrophoresis  (d) Simultaceus deposition of two metal ions occurs, provided the discharge potential
	of these two lons is (ii) same
	high
	[ TURN OVER
1	

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QP -	
4	
OR  (B) State True or False:  (p) The base metal to be coated is made anode and coating metal is made cathode in electroplating process.  (p) The base metal to presence of impurities.  (p) The base metal to presence of impurities.  (p) The base metal to be coated is made anode and coating metal is made cathode in the basis of classical mechanics.	
(4) or metal is made called	5
and coating in	1
(B) State True or False:  (p) The base metal to be coated is made anode and coated in purities.  (p) The base metal to be coated is made anode and coated is made anode and coated in purities.  (p) The base metal to be coated is made anode and coated in purities.  (q) The base metal to be coated is made anode and coated in purities.  (q) Overvoltage is susceptible to presence of impurities.  (q) Overvoltage is susceptible to presence on the basis of classical mechanics.  (q) Overvoltage is susceptible to presence of impurities.  (q) Overvoltage is susceptible to presence of impurities.  (q) Overvoltage is not susceptible to presence of impurities.  (q) Overvoltage is not susceptible to presence of impurities.  (q) Overvoltage is not susceptible to presence of impurities.  (q) Overvoltage is not susceptible to presence of impurities.	
(B) State True or False:  (p) The base metal to be coated is made and process. (p) The base metal to be coated is made and process. (p) The base metal to be coated is made and process. (p) The base metal to be coated is made and process. (p) The base metal to be coated is made and process. (p) The base metal to be coated is made and process. (q) Overvoltage is susceptible to presence of impurities. (q) Overvoltage is susceptible to presence of impurities. (q) Overvoltage is susceptible to presence of impurities. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of classical mechanics. (iii) Photoelectric effect can be explained on the basis of can be explained on the basis of can be explained on the basis of can be explained on the b	
(B) State The base metal to presence of the basis of splacement.	
(B) State True or False.  (p) The base metal to be coated to presence of impurition of classical five electroplating process.  (p) The base metal to be coated to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence on the basis of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.  (q) Overvoltage is susceptible to presence of impurition of classical five electroplating process.	
(a) Overvoltage is effect can be are the points	
(r) Photoelectife waves, nodes	
(s) For standard (iii) 10	
(r) Photoelect (s) For standing waves, now (s) For standing waves, now (s) For standing waves, now (iii) 10 (iiii) 10 (iiiii) 10 (iiii) 10 (iiiii) 10 (iiiii) 10 (iiiii) 10 (iiiiiii) 10 (iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	
5. (C) Fill in the blanks with 1/2  (ii) 3/2  (iii) 3/2  Slow-flow (iii) 1/2  Slow-flow (iiii) 1/2  Slow-flow (iii	
(a) 1/2 and to study the ulture flow electrical energy.	
method is used (ii) Stop-not energy into mechanical	
(b) Short-flow which convert benical a given by	
(ii) Chemical are devices will (iii) chemical are grant 21 + 1	
(i) solar solar (iii) solar (iii) 21	
(d) Total number of post (ii) $21 + 72$ .5	
(i) $I+1$ OR	
(C) Match the following:-  (i) TMS in ion cell  Lithium ion cell  Lithium ion cell	
(b) Fast reaction (ii) Lithum 10-4 dm3.mol-1 s <sup>-1</sup>	
(q) Slow reaction (iii) 10 <sup>2</sup> to 10 <sup>5</sup> dm <sup>3</sup> .mol <sup>-1</sup> .s <sup>-1</sup>	
(q) Slow read (iv) 10 <sup>2</sup> to 10 <sup>3</sup> dm <sup>2</sup> . Inot (iv) Bacon's cell (v)	
(p) Fast reaction (q) Slow reaction (r) Internal standard (s) Fuel cell  (ii) 10-7 to 10-4 dm3.mol-1.s-1 (iv) 102 to 105 dm3.mol-1.s-1 (vi) Bacon's cell (vi) 10-4 to 10-1 dm3.mol-1.s-1	
5. (D) Fill in the blanks with appropriate choice.  5. (D) Fill in the blanks with appropriate choice.  (iii) K = 1 (iii) K>1	
5. (D) Fill in the blanks with appropriate choice.  (a) Nuclear fission reaction is not self sustainable, if  (ii) K=1  (iii) K>1	
(a) Nuclous 4(1)	
Nuttal rule is given as	
(i) $\log_{10} A = B + \log_{10} R$ (ii) $\log_{10} R = 11.23310$	
$\log \lambda = A \log_{10} R + B$	
il it of a radiocicultum in the interest in th	
(c) Rutherford activity of a radio (ii) 3.7 x 10 <sup>6</sup> dps	
(iii) 106 dps	
OK .	
5. (D) State True of False:-  (p) In secular equilibrium, the half life of parent element is far greater than half life	
(p) In secular equilibrium, the half life of parent element.	
of daughter element.  (a) The penetration power of γ rays is very low while ionization power is very high.	
(r) <sup>238</sup> U is a fertile material while <sup>235</sup> U is a fissile material.	
×'	
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