



**SIR PADAMPAT SINGHANIA UNIVERSITY  
UDAIPUR**

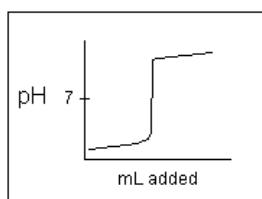
**Sample Question Paper for Ph.D. (Chemistry)  
SPSAT'18**

**INSTRUCTIONS**

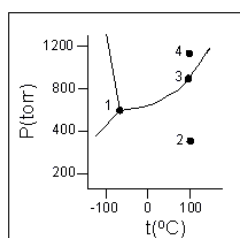
The test is 60 minutes long & consists of 40 multiple choice questions (MCQ) adding up to 40 marks.

- Which form of electromagnetic radiation has the greatest energy?  
(a) Infrared radiation, approximately 10 nm    (b) UV radiation, approximately 200 nm  
(c) Microwaves, approximately 10 mm    (d) X-rays, approximately 100 pm
- Identify the INCORRECT statement.  
(a) Helium in a balloon: an element    (b) Paint: a mixture  
(c) Tap water: a compound    (d) Mercury in a barometer; an element
- Guanidine,  $\text{HNC}(\text{NH}_2)_2$ , is a fertilizer. To three significant figures, what is the percent by mass of nitrogen in the fertilizer?  
(a) 49.4%    (b) 54.8%    (c) 65.1%    (d) 71.1
- Balance the following equation with the smallest whole number coefficients. Choose the answer that is the sum of the coefficients in the balanced equation. Do not forget coefficients of "one."  
$$\text{Cr}_2(\text{SO}_4)_3 + \text{RbOH} \rightarrow \text{Cr}(\text{OH})_3 + \text{Rb}_2\text{SO}_4$$
  
(a) 10    (b) 12    (c) 13    (d) 14
- Which one of the following statements is TRUE?  
(a) One mole of any acid will ionize completely in aqueous solution to produce one mole of  $\text{H}^+$  ions.  
(b) Solutions of weak acids always have lower concentrations of  $\text{H}^+$  than solutions of strong acids.  
(c) There are several common acids that are insoluble.  
(d) All of the IA & IIA metal hydroxides are soluble.
- The bond dissociation energy is the amount of energy required to break a bond  
(a) So as to produce the more stable pair of ions  
(b) Heterolytically    (c) Homolytically    (d) Via hydrogenation
- Which of the following is an ionic hydride?  
(a)  $\text{PH}_3$     (b)  $\text{H}_2\text{S}$     (c)  $\text{HI}$     (d)  $\text{KH}$
- Which of the following does not have a noble gas electron configuration?  
(a)  $\text{S}^{2-}$     (b)  $\text{Ba}^+$     (c)  $\text{Al}^{3+}$     (d)  $\text{Sb}^{3-}$

9. The correct dot formulation for nitrogen trichloride has:
- 3 N-Cl bonds & 10 lone pairs of electrons.
  - 3 N=Cl bonds & 6 lone pairs of electrons.
  - 1 N-Cl bond, 2 N=Cl bonds & 7 lone pairs of electrons.
  - 2 N-Cl bonds, 1 N=Cl bond & 8 lone pairs of electrons.
10. Which molecule has a linear arrangement of all component atoms?
- CH<sub>4</sub>
  - H<sub>2</sub>O
  - CO<sub>2</sub>
  - NH<sub>3</sub>
11. The following titration curve is the kind of curve expected for the titration of a \_\_\_\_\_ acid with a \_\_\_\_\_ base.



- Strong, strong
  - Weak, strong
  - Strong, weak
  - Weak, weak
12. The perchloric acid molecule contains:
- 9 lone pairs, no  $\pi$  bonds, & 6  $\sigma$  bonds.
  - 8 lone pairs, 2  $\pi$  bonds, & 7  $\sigma$  bonds.
  - 2 lone pairs, 3  $\pi$  bonds, & 4  $\sigma$  bonds.
  - 11 lone pairs, no  $\pi$  bonds, & 5  $\sigma$  bonds
13. What is the bond order in O<sub>2</sub><sup>+</sup>?
- 3.5
  - 2.0
  - 1.5
  - 2.5
14. Antibonding molecular orbitals are produced by
- Constructive interaction of atomic orbitals.
  - Destructive interaction of atomic orbitals.
  - The overlap of the atomic orbitals of two negative ions
  - All of these
15. Which one of the following is an amphoteric metal hydroxide?
- KOH
  - Ba(OH)<sub>2</sub>
  - Pb(OH)<sub>2</sub>
  - LiOH
16. According to the phase diagram given for Compound Y, what description is correct?





- (a) Polyhexene      (b) Polypropylene      (c) Polystyrene      (d) Polyethylene

26. Hydrolysis (saponification) of a fat would yield \_\_\_\_\_ .

- (a) Water & an alkene      (b) Ethanol & propanoic acid  
(c) Glycerol & soap      (d) Ethanol & a soap

27. A strong signal at  $3400\text{ cm}^{-1}$  in an IR spectrum indicates the presence of a(n)

- (a) Alcohol      (b) Ether      (c) Carbonyl      (d) Amine

28. Which of the following occurs during the initiation stage of a radical mechanism?

- (a) Nonradicals are formed from radicals.      (b) Radicals are formed from other radicals.  
(c) Radicals are formed from nonradicals.  
(d) Nonradicals are formed from other nonradicals.

29. Which of the following physical properties differ for each of a pair of enantiomers?

- (a) Solubility in ethanol      (b) Direction of rotation of plane-polarized light  
(c) Boiling point & melting point      (d) Index of refraction

30. Propane gas,  $\text{C}_3\text{H}_8$ , burns in excess oxygen gas. When the equation for this reaction is correctly balanced & all coefficients are reduced to their lowest whole-number terms, the coefficient for  $\text{O}_2$  is:

- (a) 4      (b) 5      (c) 7      (d) 10

31. Picric acid & benzoic acid can be distinguished by the aqueous solution of \_\_\_\_\_.

- (a)  $\text{NaHCO}_3$       (b)  $\text{Na}_2\text{CO}_3$       (c)  $\text{NaOH}$       (d)  $\text{FeCl}_3$

32. What number of moles of  $\text{O}_2$  is needed to produce 14.2 grams of  $\text{P}_4\text{O}_{10}$  from P? (Molecular weight  $\text{P}_4\text{O}_{10}=284$ )

- (a) 0.0500 mole      (b) 0.0625 mole      (c) 0.125 mole      (d) 0.250 mole

33. When the equation above is balanced & all coefficients are reduced to their lowest whole-number terms, the coefficient for  $\text{O}_2(\text{g})$  is:



- (a) 6      (b) 7      (c) 12      (d) 14

34. Ascorbic acid is the chemical name of \_\_\_\_\_.

- (a) Vitamin D      (b) Vitamin A      (c) Vitamin C      (d) Vitamin B6

35. Ethene is obtained from ethyl bromide by \_\_\_\_\_.

- (a) Nucleophilic substitution      (b) Hydrolysis  
(c) Simple heating      (d) Dehydrohalogenation

36. Which of the following is an example of elimination reaction?

- (a) Chlorination of methane      (b) Dehydration of ethanol  
(c) Nitration of benzene      (d) Hydroxylation of ethylene

