DPP - Daily Practice Problems

Chapter-wise Sheets

Date : | Start Time : | End Time :

CHEMISTRY CC09

SYLLABUS : Hydrogen

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. Which of the following will not displace hydrogen
   (a) Ba (b) Pb (c) Hg (d) Sn
2. Which of the following statements is correct ?
   (a) Hydrogen has same IP as alkali metals
   (b) Hydrogen has same electronegativity as halogens
   (c) It has oxidation number of –1 and +1
   (d) It will not be liberated at anode.
3. Which one of the following pairs of substances on reaction will not evolve H_2 gas ?
   (a) Iron and H_2SO_4(aq) (b) Iron and steam
   (c) Copper and HCl (aq) (d) Sodium and ethanol
4. Following are some properties of hydrogen. Which of the following properties resemble with alkali metals and which with halogens
   (i) Hydrogen lose one electron to form unipositive ions
   (ii) Hydrogen gain one electron to form uninegative ions
   (iii) Hydrogen forms oxides, halides and sulphides
   (iv) Hydrogen has a very high ionization enthalpy
   (v) Hydrogen forms a diatomic molecule, combines with elements to form hydrides and covalent compounds.
   (a) Alkali metals resemble (i), (iii) and (iv)
   Halogens resemble (ii) and (v)
   (b) Alkali metals resemble (i) and (iii)
   Halogens resemble (ii), (iii) and (v)
   (c) Alkali metals resemble (i) and (iii)
   Halogens resemble (ii), (iv) and (v)
   (d) Alkali metals resemble (i) only
   Halogens resemble (iv) and (v)

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ

Space for Rough Work

5. Match the columns

Column - I (Chemical property of water)	Column - II (Chemical equation)
A. Basic nature	I. $2H_2O(l) + 2Na(s) \longrightarrow 2NaOH(aq) + H_2(g)$
B. Auto-protolysis	II. $H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$
C. Oxidising nature	III. $2F_2(g) + 2H_2O(l) \longrightarrow 4H^+(aq) + 4F^-(aq) + O_2(g)$
D. Reducing nature	IV. $H_2O(l) + H_2S(aq) \rightleftharpoons H_3O^+(aq) + HS^-(aq)$

(a) A – IV; B – II; C – III; D – I
(b) A – IV; B – II; C – I; D – III
(c) A – III; B – II; C – IV; D – I
(d) A – I; B – II; C – IV; D – III

6. The unusual properties of water in the condensed phase (liquid and solid states) are due to the
(a) presence of hydrogen and covalent bonding between the water molecules
(b) presence of covalent bonding between the water molecules
(c) presence of extensive hydrogen bonding between water molecules
(d) presence of ionic bonding

7. Hydrogen bond energy is equal to :
(a) 3-7 cals (b) 30-70 cals
(c) 3-10 kcals (d) 30-70 kcals

8. D_2O is preferred to H_2O, as a moderator, in nuclear reactors because
(a) D_2O slows down fast neutrons better
(b) D_2O has high specific heat
(c) D_2O is cheaper
(d) The neutron absorbing ability of D_2O is higher

9. Consider the following statements :
1. Atomic hydrogen is obtained by passing hydrogen through an electric arc.
2. Hydrogen gas will not reduce heated aluminium oxide.
3. Finely divided palladium adsorbs large volume of hydrogen gas
4. Pure nascent hydrogen is best obtained by reacting Na with C_2H_5OH

Which of the above statements is/are correct ?
(a) only 1 (b) only 2
(c) 1, 2 and 3 (d) 2, 3 and 4

10. The low density of ice compared to water is due to
(a) hydrogen bonding interactions
(b) dipole–dipole interactions
(c) dipole – induced dipole interactions
(d) induced dipole – induced dipole interactions

11. What is formed when calcium carbide reacts with heavy water?
(a) C_2D_2 (b) CaD_2 (c) Ca_2D_2O (d) CD_2

12. Which of the following is formed on reaction of carbon monoxide gas with dihydrogen in presence of cobalt as a catalyst?
(a) Methanal (b) Methanol
(c) Methane (d) Formic acid

13. Water possesses a high dielectric constant, therefore
(a) it always contains ions
(b) it is a universal solvent
(c) can dissolve covalent compounds
(d) can conduct electricity

14. The m.p. of most of the solid substances increase with an increase of pressure . However ice melts at a temperature lower than its usual melting point when pressure is increased. This is because
(a) ice is less denser than H_2O
(b) pressure generates heat
(c) the chemical bonds break under pressure
(d) ice is not a true solid

15. In context with the industrial preparation of hydrogen from water gas (CO + H_2), which of the following is the correct statement?
(a) CO and H_2, are fractionally separated using differences in their densities
(b) CO is removed by absorption in aqueous Cu_2Cl_2 solution
(c) H_2 is removed through occlusion with Pd
(d) CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of of CO_2 in alkali

RESPONSE GRID					
	5. ⓐⓑⓒⓓ	**6.** ⓐⓑⓒⓓ	**7.** ⓐⓑⓒⓓ	**8.** ⓐⓑⓒⓓ	**9.** ⓐⓑⓒⓓ
	10. ⓐⓑⓒⓓ	**11.** ⓐⓑⓒⓓ	**12.** ⓐⓑⓒⓓ	**13.** ⓐⓑⓒⓓ	**14.** ⓐⓑⓒⓓ
	15. ⓐⓑⓒⓓ				

Space for Rough Work

16. Calculate the normality of 10 volume H_2O_2 ?
(a) 1.7N (b) 12N (c) 30.3N (d) 0.0303N

17. The hydride ion H^- is stronger base than its hydroxide ion OH^-. Which of the following reactions will occur if sodium hydride (NaH) is dissolved in water ?
(a) $H^-(aq) + H_2O \rightarrow H_3O^-$
(b) $H^-(aq) + H_2O(l) \rightarrow OH^- + H_2$
(c) $H^- + H_2O \rightarrow$ No reaction
(d) None of these

18. Match list I with list II and select the correct answer using the codes given below the lists :

List I	List II
A. Heavy water	I. Bicarbonates of Mg and Ca in water
B. Temporary hard water	II. No foreign ions in water
C. Soft water	III. D_2O
D. Permanent hard water	IV. Sulphates & chlorides of Mg & Ca in water

(a) A–III; B–IV; C–II; D–I (b) A–II; B–I; C–III; D–IV
(c) A–II; B–IV; C–III; D–I (d) A–III; B–I; C–II; D–IV

19. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour to a smokeless flame of Bunsen burner. A, B, C and D respectively are
(a) Na, H_2, NaOH, Zn (b) K, H_2, KOH, Al
(c) Ca, H_2, $Ca(OH)_2$, Sn (d) CaC_2, C_2H_2, $Ca(OH)_2$, Fe

20. At its melting point ice is lighter than water because
(a) H_2O molecules are more closely packed in solid state
(b) ice crystals have hollow hexagonal arrangement of H_2O molecules.
(c) on melting of ice the H_2O molecule shrinks in size
(d) ice froms mostly heavy water on first melting

21. H_2O_2 is commonly prepared in lab. by the reaction of
(a) $PbO_2 + H_2SO_4$ (b) $MnO_2 + H_2SO_4$
(c) $BaO_2 + H_2O + CO_2$ (d) $Na_2O_2 + H_2O$

22. Which of the following is formed by the action of water on sodium peroxide
(a) H_2 (b) N_2 (c) O_2 (d) CO_2

23. The reaction, $2H_2O_2 \rightarrow 2H_2O + O_2$
shows that H_2O_2 :
(a) acts as reducing agent (b) acts as oxidising agent
(c) is decomposed (d) None of these

24. True peroxide is
(a) BaO_2 (b) MnO_2 (c) PbO_2 (d) NO_2

25. The component present in greater proportion in water gas is
(a) CH_4 (b) CO_2 (c) CO (d) H_2

26. Which physical property of dihydrogen is wrong ?
(a) Odourless gas (b) Tasteless gas
(c) Colourless gas (d) Non–inflammable gas

27. In which of the following reactions, H_2O_2 acts as a reducing agent?
(a) $PbO_2(s) + H_2O_2(aq) \rightarrow PbO(s) + H_2O(l) + O_2(g)$
(b) $Na_2SO_3(aq) + H_2O_2(aq) \rightarrow Na_2SO_4(aq) + H_2O(l)$
(c) $2KI(aq) + H_2O_2(aq) \rightarrow 2KOH(aq) + I_2(s)$
(d) $KNO_2(aq) + H_2O_2(aq) \rightarrow KNO_3(aq) + H_2O(l)$

28. In which of the following reactions, H_2O_2 is acting as a reducing agent
(a) $H_2O_2 + SO_2 \rightarrow H_2SO_4$
(b) $2KI + H_2O_2 \rightarrow 2KOH + I_2$
(c) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$
(d) $Ag_2O + H_2O_2 \rightarrow 2Ag + H_2O + O_2$

RESPONSE GRID					
	16. (a)(b)(c)(d)	17. (a)(b)(c)(d)	18. (a)(b)(c)(d)	19. (a)(b)(c)(d)	20. (a)(b)(c)(d)
	21. (a)(b)(c)(d)	22. (a)(b)(c)(d)	23. (a)(b)(c)(d)	24. (a)(b)(c)(d)	25. (a)(b)(c)(d)
	26. (a)(b)(c)(d)	27. (a)(b)(c)(d)	28. (a)(b)(c)(d)		

Space for Rough Work

29. Commercial 10 volume H_2O_2 is a solution with a strength of approximately
(a) 15% (b) 3%
(c) 1% (d) 10%

30. Which of the following is not true?
(a) D_2O freezes at lower temperature than H_2O
(b) Reaction between H_2 and Cl_2 is much faster than D_2 and Cl_2
(c) Ordinary water gets electrolysed more rapidly than D_2O
(d) Bond dissociation energy of D_2 is greater than H_2

31. When zeolite (hydrated sodium aluminium silicate) is treated with hard water the sodium ions are exchanged with
(a) H^+ ions (b) Ca^{2+} ions
(c) SO_4^{2-} ions (d) OH^- ions

32. The oxide that gives H_2O_2 on treatment with a dil. acid is
(a) Na_2O_2 (b) PbO_2 (c) TiO_2 (d) MnO_2

33. Which statement is wrong?
(a) Ordinary hydrogen is an equilibrium mixture of ortho and para hydrogen
(b) In ortho hydrogen spin of two nuclei is in same direction
(c) Ortho and para forms do not resemble in their chemical properties
(d) In para hydrogen spin of two nuclei is in opposite direction.

34. Water contracts on heating
(a) to 100°C (b) from 0°C to 4°C
(c) to 273 K (d) from 10°C to 20°C

35. Water is :
(a) more polar than H_2S
(b) more or less identical in polarity with H_2S
(c) less polar than H_2S
(d) None of these

36. $LiAlH_4$ is used as :
(a) An oxidizing agent (b) A reducing agent
(c) A mordant (d) A water softener

37. Hydrogen is not obtained when Zn reacts with
(a) cold water (b) dil H_2SO_4
(c) dil. HCl (d) 20% NaOH

38. An inorganic compound gives off O_2 when heated, turns an acidic solution of KI violet and reduces acidified $KMnO_4$. The compound is
(a) SO_3 (b) KNO_3
(c) H_2O_2 (d) All of these

39. The species that does not contain peroxide ions
(a) PbO_2 (b) H_2O_2 (c) SrO_2 (d) BaO_2

40. Metal hydrides are ionic, covalent or molecular in nature. Among LiH, NaH, KH, RbH, CsH, the correct order of increasing ionic character is
(a) LiH > NaH > CsH > KH > RbH
(b) LiH < NaH < KH < RbH < CsH
(c) RbH > CsH > NaH > KH > LiH
(d) NaH > CsH > RbH > LiH > KH

41. Which of the following in incorrect statement?
(a) s-block elements, except Be and Mg, form ionic hydride
(b) BeH_4, MgH_2, CuH_2, ZnH_2, CaH_2 and HgH_2 are intermediate hydride
(c) p-block elements form covalent hydride
(d) d-and f-block elements form ionic hydride

42. The decomposition of H_2O_2 is accelerated by –
(a) glycerine (b) alcohol
(c) phosphoric acid (d) Pt powder

43. The molarity of a 100 ml solution containing 5.1 g of hydrogen peroxide is
(a) 0.15 M (b) 1.5 M (c) 3.0 M (d) 50.0 M

44. Permanent hardness of water can be removed by adding Calgon $(NaPO_3)_n$. This is an example of
(a) adsorption (b) exchange of ion
(c) precipitation (d) None of these.

45. The oxidation states of most electronegative element in the products of reaction BaO_2 with dil. H_2SO_4 are
(a) 0 and – 1 (b) – 1 and – 2
(c) – 2 and 0 (d) – 2 and + 1

RESPONSE GRID					
	29. ⓐⓑⓒⓓ	30. ⓐⓑⓒⓓ	31. ⓐⓑⓒⓓ	32. ⓐⓑⓒⓓ	33. ⓐⓑⓒⓓ
	34. ⓐⓑⓒⓓ	35. ⓐⓑⓒⓓ	36. ⓐⓑⓒⓓ	37. ⓐⓑⓒⓓ	38. ⓐⓑⓒⓓ
	39. ⓐⓑⓒⓓ	40. ⓐⓑⓒⓓ	41. ⓐⓑⓒⓓ	42. ⓐⓑⓒⓓ	43. ⓐⓑⓒⓓ
	44. ⓐⓑⓒⓓ	45. ⓐⓑⓒⓓ			

Space for Rough Work

DAILY PRACTICE PROBLEMS — CHEMISTRY SOLUTIONS — DPP/CC09

1. **(c)** Hg will not displace hydrogen since it is present below hydrogen in ECS.
2. **(c)** In metal hydrides the O.S. of hydrogen –1 otherwise it is +1.
3. **(c)**
4. **(c)** (i) and (iii) are properties of hydrogen which shows its resemblance with alkali metals whereas (ii), (iv) and (v) shows resemblance with halogens.
5. **(b)**
6. **(c)** The unusual properties of water in the condensed phase (liquid an solid states) are due to the presence of extensive hydrogen bonding between the water molecules.
7. **(c)** Hydrogen bond is weak force of attraction existing between molecules. Its energy is equal to 3-10 k cals.
8. **(d)** H_2O absorbs neutrons more than D_2O and this decreases the number of neutrons for the fission process.
9. **(c)**
10. **(a)** It is due to hydrogen bonding when H_2O forms a cage like structure in solid ice and density is reduced.
11. **(a)** $CaC_2 + 2D_2O \rightarrow C_2D_2 + Ca(OD)_2$
12. **(b)** $CO(g) + 2H_2(g) \xrightarrow[\text{catalyst}]{\text{cobalt}} CH_3OH(l)$
13. **(b)** Due to high dielectric constant, water acts as a good solvent therefore it is also called a universal solvent.
14. **(a)** ice occupy more volume than liquid water (ice $\rightleftharpoons$ water). Increase of pressure favours forward reaction (Le-Chatelier's principle).
15. **(d)** On the industrial scale hydrogen is prepared from water gas according to following reaction sequence

$$\underbrace{CO + H_2}_{\text{water gas}} + \underbrace{H_2O}_{\text{(steam)}} \xrightarrow{\text{catalyst}} CO_2 + 2H_2$$

$$\xrightarrow[\text{(alkali)}]{2NaOH} Na_2CO_3 + H_2O$$

From the above reaction it is clear that CO is first oxidised to CO_2 which is then absorbed in NaOH.

16. **(a)** Normality of 10V of H_2O_2

$$\frac{68 \times 10}{22.4} = 17 \times N \quad \therefore N = 1.78$$

17. **(b)** $H^-(aq) + H_2O(l) \rightarrow OH^- + H_2$. Since H^- is a strong base it will abstract H^+ to form H_2.
18. **(d)** Heavy water is D_2O (1–C); Temporary hard water contains the bi-carbonates of Mg and Ca (2–A); Soft water contains no foreign ions (3–B); Permanent hard water contains the sulphates and chlorides of Mg and Ca (4–D) therefore the answer is D.
19. **(a)** $\underset{\text{'A'}}{2Na} + 2H_2O \rightarrow \underset{\text{'C'}}{2NaOH} + \underset{\text{'B'}}{H_2}\uparrow$

$\underset{\text{'D'}}{Zn} + 2\underset{\text{'C'}}{NaOH} \rightarrow Na_2ZnO_2 + \underset{\text{'B'}}{H_2}\uparrow$

$\underset{\text{'D'}}{Zn} + \text{dil. } H_2SO_4 \rightarrow ZnSO_4 + \underset{\text{'B'}}{H_2}\uparrow$

Na produces golden yellow colour with smokeless flame of Bunsen burner.

20. **(b)** In the structure of ice each molecule of H_2O is surrounded by three H_2O molecules in hexagonal honey comb manner. On the other in water, each molecule is surrounded by four neighbouring molecules randomly which results an open cage like structure. As a result there are a number of 'hole' or open spaces. In such a structure lesser number of molecules are packed per ml. When ice melts a large no. of hydrogen bonds are broken. The molecules therefore move into the holes or open spaces and come closer to each other than they were in solid state. This result sharp increase in the density. Therefore ice has lower density than water.
21. **(c)** $BaO_2 + H_2O + CO2 \rightarrow$ $BaCO_3 + H_2O_2$ (Merck process)
22. **(c)** $Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$

$2H_2O_2 \rightarrow 2H_2O + O_2$

23. **(c)** $2H_2O_2 \rightarrow 2H_2O + O_2$

The reaction is decomposition of H_2O_2.

24. **(a)** True peroxide contains O – O linkage and O_2^{2-} ion. They give hydrogen peroxide with dil H_2SO_4.

$BaO_2 + H_2SO_4\,(\text{dil.}) \rightarrow BaSO_4 + H_2O_2$

25. **(d)** Composition of water gas is 40-50% CO, 44-50% H_2, 3-7% CO_2 and 4-5% N_2
26. **(d)** H_2 is a highly intlammable gas.
27. **(a)** $PbO_2 \rightarrow PbO$ (change in O.S. is +4 to +2 hence reduction)
28. **(d)** SO_2 changes to H_2SO_4 (O.N. changes from +4 to +6 oxidation)

$2KI \rightarrow I_2$ (O.S. changes from –1 to 0 oxidation)

$PbS \rightarrow PbSO_4$ (O.S. changes from –2 to +6 oxidation)

$Ag_2O \rightarrow 2Ag$ (O.S. changes from +1 to 0 reduction)

29. **(b)** Strength of 10 volume $H_2O_2 = \frac{68 \times 10}{22400} \times 100 = 3.035\%$

30. **(a)** D_2O actually has higher freezing point (3.8°C) than water H_2O (0°C)

31. **(b)** Na_2 zeolite + $CaCl_2 \rightarrow$ Ca zeolite + 2NaCl

32. **(a)** $Na_2O_2 + 2HCl \rightarrow 2NaCl + H_2O_2$

33. **(c)** Ortho and para forms of hydrogen resemble in their chemical properties.

34. **(b)** When water is heated from 0°C to 4°C , its density increases and volume decreases. $\left(d = \frac{m}{V}\right)$

35. **(a)** Polarity of bond depends on difference in electronegativity of the two concerned atoms. H_2O is more polar than H_2S because oxygen (in O–H) is more electronegative than sulphur (in S–H).

36. **(b)** $LiH + AlCl_3 \longrightarrow (AlH_3)_n \xrightarrow[LiH]{excess} LiAlH_4$

Litbuim aluminium hydride is a most useful organic reducing agent. It reduces fi.nctional groups but does not attack double bonds.

37. **(a)** Only elements having reduction potential less than -0.41V liberate hydrogen with cold water.

38. **(c)** $2H_2O_2 \xrightarrow{\Delta} 2H_2O + O_2$

$2KI + H_2O_2 \rightarrow 2KOH + I_2$

$2KMnO_4 + 3H_2SO_4 + 5H_2O_2 \rightarrow$

$K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$

39. **(a)** PbO_2 is lead dioxide and does not contain O – O bonds and O_2^{2-} ions.

40. **(b)**

41. **(d)** d- and f-block elements form metallic hydride. While p-block elements form covalent hydrides, s-block elements except Be and Mg form ionic hydrides. Hydrides of Be, Mg, Cu, Zn, Ca and Hg are intermediate hydrides.

42. **(d)** Decomposition of H_2O_2 can be accelerated by finely divided metals such as Ag, Au, Pt, Co, Fe etc.

43. **(b)** $M = \frac{5.1 \times 1000}{34 \times 100} = 1.5$

44. **(b)** This is an example of exchange of ions.

45. **(b)** $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$.

oxygen has common O.S. as –2 and in peroxides as –1.