Hydrogen

Set – 1

Table 9.1 Atomic and Physical Properties of Hydrogen

Property	Hydrogen	Deuterium	Tritium
Relative abundance (%)	99.985	0.0156	10^{-15}
Relative atomic mass (g mol^{-1})	1.008	2.014	3.016
Melting point / K	13.96	18.73	20.62
Boiling point/ K	20.39	23.67	25.0
Density / gL^{-1}	0.09	0.18	0.27
Enthalpy of fusion/kJ mol^{-1}	0.117	0.197	-
Enthalpy of vaporization/kJ mol^{-1}	0.904	1.226	-
Enthalpy of bond dissociation/kJ mol^{-1} at 298.2K	435.88	443.35	-
Internuclear distance/pm	74.14	74.14	-
Ionization enthalpy/kJ mol^{-1}	1312	-	-
Electron gain enthalpy/kJ mol^{-1}	–73	-	-
Covalent radius/pm	37	-	-
Ionic radius(H^-)/pm	208		

Q1. Which of the following is the correct order of melting point for isotopes of Hydrogen?

A. H
B. D
C. D
D. T

Ans. (A)

Q2. Which of the following is the correct order of boiling point for isotopes of Hydrogen?

A. D
B. T
C. T
D. H

Ans. (D)

Q3. Which of the following is the correct order of Density for isotopes of Hydrogen?

A. T
B. H
C. H
D. D

Ans. (B)

Q4. Which of the following is correct order of enthalpy of bond dissociation of isotopes of Hydrogen?

A. H
B. D
C. H=D
D. None of these

Ans. (A)

Q5. Which of the following is correct order of enthalpy of fusion of isotopes of Hydrogen?

A. D
B. H
C. H=D
D. None of these

Ans. (A)

Q6. Which of the following is the correct order of internuclear distance of isotopes of Hydrogen?

A. H
B. D
C. H=D
D. None of these

Ans. (C)

Q7. Which isotope of hydrogen is the most abundant?

A. Protium
B. Deuterium
C. Tritium
D. Hydrogen-2

Ans. (A)

Q8. Hydrogen exist in Diatomic form rather than monoatomic form under normal conditions-

A. due to high I.E.
B. due to low I.E.
C. due to high electron gain enthalpy
D. due to low electron gain enthalpy

Ans. (A)

Q9. ! Which of the following order are true- i)Tritium>Deuterium>Hydrogen(BP order) ii)Tritium>Deuterium>Hydrogen(Density order)
iii)Hydrogen>Deuterium>Tritium(MP order)
iv)Tritium>Deuterium>Hydrogen(bond energy)

A. I and ii
B. I,ii and iii
C. iii and iv
D. i ,iiand iv

Ans. (D)

Q10. Atomic hydrogen combines with almost all elements but molecular hydrogen does not because

A. Atomic hydrogen is a highly unstable molecular, hydrogen is almost inert at room temperature.
B. Atomic hydrogen is highly inert, molecular hydrogen is almost unstable at room temperature.
C. Atomic hydrogen and molecular hydrogen are unstable.
D. Atomic hydrogen and molecular hydrogen are inert.

Ans. (A)

Q11. H+ ions always get associated with other atoms or molecules due to

A. ionisation enthalpy of hydrogen resembles that of alkali metals
B. Its reactivity is similar to halogens
C. It resembles both alkali metals and halogens
D. Loss of an electron from hydrogen atom results in a nucleus of very small size as compared to other atoms or ions Due to small size it cannot exist free

Ans. (D)

Q12. Which of following order is correct-

A. Deuterium>Hydrogen(Enthalpy of fusion)
B. Hydrogen>Deuterium(Enthalpy of bond dissociation)
C. Deuterium>Hydrogen(Enthalpy of vaporisation)
D. a and c both

Ans. (D)

Set – 2

Table 9.3 Physical Properties of H_2O and D_2O

Property	H_2O	D_2O
Molecular mass (g mol^{-1})	18.0151	20.0276
Melting point/K	273.0	276.8
Boiling point/K	373.0	374.4
Enthalpy of formation/kJ mol^{-1}	–285.9	–294.6
Enthalpy of vaporisation (373K)/kJ mol^{-1}	40.66	41.61
Enthalpy of fusion/kJ mol^{-1}	6.01	
Temp of max. density/K	276.98	284.2
Density (298K)/g cm^{-3}	1.0000	1.1059
Viscosity/centipoise	0.8903	1.107
Dielectric constant/$C^2/N.m^2$	78.39	78.06
Electrical conductivity (293K/ohm^{-1} cm^{-1})	5.7×10^{-8}	-

Q1. Which of the following options is the correct order of melting point of H2O and D2O?

A. $H_2O>D_2O$
B. H_2O2O

C. H2O=D2O
D. None of the above

Ans. (B)

Q2. Which of the following options is the correct order about boiling point of H2O and D2O?

A. H_2O2O
B. H2O=D_2O
C. H_2O>D_2O
D. None of the above

Ans. (A)

Q3. Which of the following options is correct order of Enthalpy of formation of H2O and D2O?

A. H_2O=D_2O
B.H_2O>D_2O
C. H_2O2O
D. None of the above

Ans. (B)

Q4. Which of the following options is the correct order of Dielectric constant of H2O and D2O?

A. H_2O2O
B. H2O=D2O
C. H_2O>D_2O
D. None of the above

Ans. (C)

Q5. Which of the following options is the correct order of Enthalpy of Vaporisation of H2O and D2O?

A. H_2O2O
B. H_2O=D_2O
C. H_2O>D_2O
D. None of the above

Ans. (A)

Q6. Which of the following are correct statements- i)H2O ice cubes float in D2O liquid state. ii)H2O ice cubes sink in H2O liquid state. iii)D2O ice cubes sink in H2O liquid state. iv)D2O ice cubes float in D2O liquid state.

A. i,iii,iv
B. i,ii
C. iii,ii
D. ii,i,iii

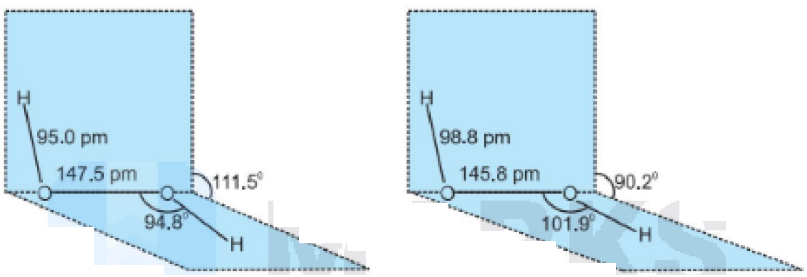
Ans. (A)

Q7. Physical properties in which D2O differ from H2O is/are-

A. Solubility of salts in heavy water is less than ordinary water.
B. all physical constants of D2O are higher than H2O.
C. heavy water is 11% lighter than normal water.
D. all of the above

Ans. (D)

Set – 3



(a) Gas phase (b) Solid phase

Fig. 9.3 *(a) H_2O_2 structure in gas phase, dihedral angle is 111.5°. (b) H_2O_2 structure in solid phase at 110K, dihedral angle is 90.2°.*

Q1. Which of the following is the correct order of O–H bond length of H2O2in various states?

A. O-H_{Solid}Gas
B. O-HSolid>O-Hgas
C. O-H_{Solid}=O-H_{Gas}
D. None of these

Ans. (B)

Q2. Which of the following is the correct order of O–O bond length of H2O2in various states?

A. O-O_{Solid}<o-o_{Gas}</o-o
B. O-O_{Solid}>O-O_{Gas}
C. O-O_{Solid}=O-O_{Gas}
D. None of these

Ans. (A)

Q3. Which of the following is the correct order of O-O-H bond angle of H2O2in various states?

A. O-O-H_{Solid}=O-O-H_{Gas}
B. O-O-H_{Solid}Gas
C. O-O-H_{Solid}>O-O-H_{Gas}
D. None of these

Ans. (C)

Q4. Which of the following is correct about the dihedral angle of H2O2in various states?

A. Dihedral angle in gas phase< Dihedral angle in solid phase
B. Dihedral angle in gas phase> Dihedral angle in solid phase
C. Dihedral angle in gas phase= Dihedral angle in solid phase
D. None of the above

Ans. (B)