1-When a sufficient number of properties of a system have specified, fixed values, the system is at
   a-motion         b-stability        c-equilibrium   d-all of them   e-none of them

2-The first law of thermodynamics is a statement of the principle of
   a-production of energy  b-consumption of energy  c-conservation of energy
d-all of them             e-none of them

3- The internal energy of a system is not a state function.
   a-True               b-False

4-The change in the internal energy depends only on
   a-how the change in state was achieved and does not depend on the initial and final state.
b-the initial and final state and on how the change in state was achieved.
c-the initial and final state and does not depend on how the change in state was achieved
d-all of them          e-none of them
5. The concept of work in thermodynamics may be expressed as a product of
a- intensity & capacity factor  b- enthalpy & entropy  c- pressure & volume
d- all of them  e- none of them

6. Some peculiarities of the work are that it appears only at the
a- central  b- boundary  c- a & b  d- all of them  e- none of them

7. Work may be generated only through a change in the
a- temperature of the system  b- volume of the system  c- state of the system
d- all of them  e- none of them

8. The convention chosen is that if the system does work on the surroundings, the
work is a
a- positive quantity  b- negative quantity  c- neutral quantity  d- all of them  e- none of them

9. The boundary of a system can be rigid i.e.
a- allow PV work  b- not allow PV work  c- no relation  d- all of them  e- none of them

10. Hess’ law, which states that the enthalpy change
a- of a reaction is the sum of several steps.
b- of a reaction is the same, whether it occurs in one or several steps.
c- of a reaction is the difference, between two steps.
d- all of them  e- none of them

11. Both heat and work are state functions of the system.
a- True  b- False

12. Adiabatic boundaries
a- allow free exchange of heat  b- do not allow heat flow
b- allow PV work  c- do not allow PV work  d- all of them  e- none of them

13. The highest temperature at which a given liquid can exist is its
a- triple point  b- melting point  c- critical temperature
b- supercritical temperature  e- none of these

14. When a state of matter gains heat it undergoes.
a- exothermic change  b- endothermic change  c- no change  d- melting  e- none of them

15. Consider the following two equations
a- \( C(s) + O_2(g) = CO(g) + \frac{1}{2} O_2 \) \( \Delta H = -26,416 \text{ cal} \)
b- \( CO(g) + \frac{1}{2} O_2(g) = CO_2(g) \) \( \Delta H = -67,636 \text{ cal} \)

The enthalpy change associated with the reaction
a- \( C(s) + O_2(g) = CO_2(g) \) will be:
a- 16,688 cal  b- -161,688 cal  c- 26,416 cal  d- -94,052 cal  e- none of them
16. the enthalpy is no more than the
a-heat emitted by the system under the condition of constant pressure.
b-heat emitted by the system under the condition of different pressure.
c-heat absorbed by the system under the condition of different pressure.
d-heat absorbed by the system under the condition of constant pressure. e-none of them

17. Consider the following reaction which represents both a mass and energy balanced equation
\[ \text{H}_2 (g, 1 \text{ atm}) + \frac{1}{2} \text{O}_2 (g, 1 \text{ atm}) = \text{H}_2\text{O} (l) \]
where, \( \Delta H_{298} \) is defined as the :
a-heat of boiling b-heat of oxidation c-heat of reaction d-all of them e-none of them

18. This quantity specifies the change in
a-entropy of the above reaction as written at the specified temperature of 298 °K.
b-enthalpy of the above reaction as written at the specified temperature of 298 °K.
c-state of the above reaction as written at the specified temperature of 298 °K.
d-all of them e-none of them

19. The implication of the reaction in point 17 is that when a mole of \( \text{H}_2 \) combines with \( \frac{1}{2} \) mol of \( \text{O}_2 \) at 298 °K, 68,300 cal of heat are released and the reaction is
a-exothermic b-endothermic c-adiabatic d-all of them e-none of them

20. Since the equation in point 17 is a balanced energy equation, the reverse reaction of the breakdown of liquid water into the respective components of \( \text{H}_2 \) and \( \text{O}_2 \) is an
a-exothermic process requiring 68,300 cal of heat b-exothermic process producing 68,300 cal of heat.
c-endothermic process requiring 68,300 cal of heat. d-endothermic process producing 68,300 cal of heat e-none of them

21. Since the enthalpy is a state function, only the difference between the initial and final state is important for determining the change in enthalpy for the entire process.
a-True b-False

22. For any spontaneous process in an isolated system, there is
a-a decrease in the value of entropy b-an increase in the value of entropy.
c-no change in the value of entropy. d-a decrease in the value of enthalpy. e-none of them

23. The first and second laws of thermodynamics may be combined with the classic thermodynamic statement,
a-"the energy of the universe is changing, the entropy is constant".
b-"the energy of the universe is constant, the entropy is constant".
c-"the energy of the universe is constant, the entropy is increasing". d-"the energy of the universe is constant, the entropy decreasing". e-none of them
24. The entropy
a. is a state function which depends only on the initial and final state of the system.
b. is not a state function as it depends only on the initial & final state of the system.
c. is a state function which depends on the method of changing the system.
d. is not a state function as it describes the method of changing the system.
e. None of them

25. The entropy, S, is the function which provides
a. qualitative description of the randomness or disorder of the system
b. qualitative description of the enthalpy of the system
c. quantitative description of the enthalpy of the system
d. quantitative description of the randomness or disorder of the system
26. Entropy is fundamental for predicting the
a. spontaneity of chemical reactions and physical changes.
b. possibility of chemical reactions
c. the possibility of physical changes.
d. spontaneity of physical changes
27. The colligative properties of a solution are those that depend on
a. number of solute molecules in solution, irrespective of whether these are electrolytes or non-electrolytes, large or small.
b. number of solute atoms in solution, irrespective of whether these are electrolytes or non-electrolytes, large or small.
c. number of solute covalent bonds in solution, irrespective of whether these are large or small.
d. number of solute particles in solution, irrespective of whether these are molecules or ions, large or small.
e. None of them

28. Substances tend to move or diffuse from regions
a. of higher concentration to regions of lower concentrations so that differences in concentration eventually disappear
b. of lower concentration to regions of higher concentrations so that differences in concentration eventually disappear
c. of high dielectric constant to regions of low dielectric constant so that differences in dielectric constant disappear
d. of low dielectric constant to regions of high dielectric constant so that differences in dielectric constant disappear
29. A solution containing 114 g of sucrose (mol wt 342) in 1000 g of water has the same osmotic pressure as a solution containing
a. 114.0 g of anhydrous dextrose (mol wt 180) in 1000 g of water
b. 180.0 g of anhydrous dextrose (mol wt 180) in 1000 g of water
c. 120.0 g of anhydrous dextrose (mol wt 180) in 1000 g of water
d. 60.0 g of anhydrous dextrose (mol wt 180) in 1000 g of water
2. None of them
30. When red blood cells are introduced into sodium chloride solutions containing less than 0.90 g of solute per 100 mL, human erythrocytes will
a. swell, and often burst  b. lose water and shrink  c. not affected  d. none of them

31. Bond formation between two atoms is produced as a result of overlapping of
a. the molecular orbitals of the two participating atoms
b. the molecular orbitals of the two participating molecules
c. the atomic orbitals of the two participating atoms
d. the atomic orbitals of the two participating molecules  e. none of these

32. When bond is formed between 2 atoms the two atomic orbitals are replaced by
a. two molecular orbitals  b. one molecular orbital  c. two new atomic orbitals
d. one atomic orbital  e. none of these

33. In case of bond formation the produced bonding orbital is of
a. less energy than antibonding orbital  b. high energy than antibonding orbital
c. equal energy with antibonding orbital  d. none of these

34. In case of bond formation the produced antibonding orbital remains empty in is
a. excited state of the atom  b. excited state of the molecule
c. ground state of the atom  d. ground state of the molecule
e. none of these

35. In case of organic compounds containing heteroatoms like N, S, O etc., these heteroatoms usually contain
a. unshared pair(s) of electrons  b. shared pair(s) of electrons  c. one electron
d. two valency electrons  e. none of these

36. Due to electrostatic attraction, dipolar molecules tend to align themselves with neighboring molecules so that the
a. positive pole of one molecule points towards the positive pole of the next one
b. negative pole of one molecule points towards the negative pole of the next one
c. positive pole of one molecule points towards the negative pole of the next one
d. none of these

37. Permanent dipoles can induce
a. a permanent electric dipole in nonpolar molecules
b. a transient electric dipole in nonpolar molecules
c. a transient electric dipole in polar molecules
d. a permanent electric dipole in polar molecules  e. none of these

38. Additive physical properties depend on
a. the kind and number of atoms in a molecule
b. the kind and number of molecules in a substance
c. the kind and number of ions in an atom

39. none of these
38- Molar volume is defined as a- the molecular weight divided by volume b- volume divided by molecular weight
the molecular weight divided by density of a liquid d- none of these
39- Partition Coefficient is defined as a- the ratio of density of certain substance to its molecular weight
b- the ratio of solubility of certain substance in aqueous phase to its solubility in non-
aqueous phase c- the ratio of solubility of certain substance in non-aqueous phase to its solubility in
aqueous phase d- none of these
40- A supercritical fluid (SCF) is a- a solid whose temperature and pressure are above the critical temperature and critical
pressure respectively.
b- a liquid whose temperature and pressure are above the critical temperature and critical
pressure respectively.
c- a gas whose temperature and pressure are above the critical temperature and critical
pressure respectively.
d- a mixture whose temperature and pressure are above the critical temperature and
critical pressure respectively.
e- none of these
41- Triple point of water is a- the one unique temperature at which liquid water and water vapor can coexist in contact
with one another.
b- the one unique temperature at which ice, and water vapor can coexist in contact with
one another.
c- the one unique temperature at which ice, and liquid water can coexist in contact with
one another.
d- the one unique temperature at which ice, liquid water and water vapor can coexist in
contact with one another.
e- none of these
42- Polymorphism is a- the existence of one or more melting point for the same substance
b- the existence of one or more density of the same substance
c- the existence of one or more crystalline and / or amorphous forms of the same solid
substance d- none of these
43- Different polymorphic forms are produced depending on such factors as a- storage temperature
b- recrystallization solvent
c- rate of cooling
d- none of these
44- Extensive properties are properties that must be a- dependent on amount b- independent on amount
c- dependent on volume d- independent on volume
e- none of these
46. The highest temperature at which a given liquid can exist is its:
   a. triple point  b. melting point  c. critical temperature.
   d. supercritical temperature  e. none of these

47. When a state of matter loses heat it undergoes:
   a. exothermic change  b. an endothermic change.
   c. melting  d. boiling  e. none of these

48. Plasma state is:
   a. a highly disordered gas that occurs at high temperatures.
   b. a highly ionized liquid that occurs at high temperatures.
   c. a highly ionized solid that occurs at high temperatures.
   d. a highly ionized gas that occurs at high temperatures.
   e. none of these

49. Water is:
   a. a mixture of hydrogen and oxygen  b. a solution of hydrogen and oxygen.
   c. a homogenous mixture of hydrogen and oxygen.
   d. a compound of hydrogen and oxygen  e. none of these

50. Mixture of phenol and water shows:
   a. lower critical solution temperature  b. upper critical solution temperature.
   c. no critical solution temperature  d. no miscibility  e. none of these

51. A solution of ethyl alcohol containing 23 grams of ethyl alcohol per liter of solution at 20°C. (Mol. weight of ethyl alcohol = 46) The concentration of this solution is:
   a. 3.5 moles liter⁻¹  b. 6.9 %  c. 69 %  d. 46.0 %  e. none of them

52. Glycerol is considered as:
   a. a polar solvent  b. a non-polar solvent  c. semi-polar solvent  d. electrolyte
   e. none of them

53. The dielectric constant of a solvent indicates the effect that a substance has when:
   a. it acts as a medium, on the ease with which 2 oppositely charged ions may be separated.
   b. it acts as a medium, on the ease with which 2 similarly charged ions may be separated.
   c. it acts as a medium, on the ease with which it dissolves non-electrolyte.
   d. it acts as a medium, on the ease with which conducts electricity.
   e. none of them

54. A mixture of 30% alcohol w/w in water should have a dielectric constant of
   (ε of water = 80 and ε of alcohol = 25)
   a. 47  b. 52.5  c. 63.5  d. 50  e. none of them

55. Glassy materials are:
   a. highly disordered  b. highly ordered  c. none of these
Q.2

Correlate the words in column A with the appropriate meaning in column B.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  A compound</td>
<td>A  the association of nonpolar groups with each other in aqueous solution.</td>
</tr>
<tr>
<td>2  Filtration</td>
<td>B  the heat absorbed when a change of state takes place without a temperature change.</td>
</tr>
<tr>
<td>3  Mass</td>
<td>C  a solid is converted directly into gas</td>
</tr>
<tr>
<td>4  Distillation</td>
<td>D  The tendency of a pair of atoms to form an ionic or a partial ionic bond is measured by the difference in their.</td>
</tr>
<tr>
<td>5  Temperature</td>
<td>E  Atoms that contain the same number of protons but a different number of neutrons</td>
</tr>
<tr>
<td>6  Isotopes</td>
<td>F  is used to separate a heterogeneous solid-liquid mixture.</td>
</tr>
<tr>
<td>7  Electronegativities</td>
<td>G  is the factor that determines the direction of heat flow.</td>
</tr>
<tr>
<td>8  Hydrophobic interaction</td>
<td>H  an invariant measure of the amount of matter in an object.</td>
</tr>
<tr>
<td>9  Sublimation</td>
<td>I  is used to resolve a homogeneous solid-liquid mixture</td>
</tr>
<tr>
<td>10 Latent heat</td>
<td>J  is a pure substance that contains more than one element.</td>
</tr>
</tbody>
</table>

**Table for Q.2 Answers**

<table>
<thead>
<tr>
<th>No.</th>
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<tbody>
<tr>
<td>1</td>
<td>J</td>
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<tr>
<td>2</td>
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GOOD LUCK