

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Choose the INCORRECT statement.

- A) A weak electrolyte is partially ionized in a water solution.
- B) A strong electrolyte is completely ionized in water solution.
- C) A strong electrolyte in solution is a good electrical conductor.
- D) A weak electrolyte in solution is a good electrical conductor.
- E) A non-electrolyte is not ionized and does not conduct an electric current.

Answer: D

2) Most water-soluble compounds of Group 1A or 2A elements are:

- A) nonelectrolytes
- B) weak electrolytes
- C) strong electrolytes
- D) weak acids
- E) strong acids

Answer: C

3) Which of the following solutions has the highest fluoride concentration?

- A) 0.05 M CaF_2
- B) 0.05 M NaF
- C) a solution having 1.5 mg F^- /L
- D) a solution having 0.06 M F^-
- E) 2.1 mg NaF/L

Answer: A

4) Which of the following is probably the poorest electrical conductor?

- A) 0.5 M K_2SO_4
- B) 0.5 M NH_3
- C) 0.5 M CaCl_2
- D) 0.5 M HF
- E) 0.5 M CH_3OH

Answer: E

5) What concentration of $\text{Fe}_2(\text{SO}_4)_3(\text{aq})$ is required for the solution to have $[\text{Fe}^{3+}(\text{aq})] = 0.32 \text{ M}$?

- A) 0.64 M
- B) 0.12 M
- C) 0.080 M
- D) 0.32 M
- E) 0.16 M

Answer: E

6) What is the concentration of $\text{Br}^-(\text{aq})$ in a solution prepared by mixing 75.0 mL of 0.62 M iron(III) bromide with 75.0 mL of water? Assume volumes are additive.

- A) 0.62 M
- B) 0.31 M
- C) 0.93 M
- D) 1.23 M
- E) 1.9 M

Answer: C

7) Which of the following pairs of aqueous solutions will give a precipitate when mixed?

- A) LiClO_4 and Ba(OH)_2
- B) NaCl and $\text{K(CH}_3\text{COO)}$
- C) AgNO_3 and $\text{Ca(ClO}_4)_2$
- D) K_3PO_4 and CaCl_2
- E) $\text{Sr(NO}_3)_2$ and KI

Answer: D

8) Choose the INCORRECT statement.

- A) A precipitate is formed when certain anions and cations react to form an insoluble ionic solid.
- B) Net ionic equations include only the actual participants of the reaction.
- C) Most ionic compounds are strong electrolytes.
- D) An acid produces hydride ions in solution.
- E) Most molecular compounds are either nonelectrolytes or weak electrolytes.

Answer: D

9) Which of the following, in aqueous solution, is most likely to behave as a weak acid?

- A) NaCN
- B) HCl
- C) NaCl
- D) NH_3
- E) HCN

Answer: E

10) The substance HI is a:

- A) salt
- B) strong base
- C) weak base
- D) strong acid
- E) weak acid

Answer: D

11) The substance KOH is a:

- A) salt
- B) strong acid
- C) strong base
- D) weak acid
- E) weak base

Answer: C

12) The substance BaCl_2 is a:

- A) strong acid
- B) salt
- C) weak acid
- D) weak base
- E) strong base

Answer: B

13) The substance NH_3 is a:

- A) weak base
- B) strong acid
- C) strong base
- D) weak acid
- E) salt

Answer: A

14) Select a statement that best describes the oxidation process.

- A) In oxidation process all elements experience an increase in oxidation state.
- B) In oxidation process only oxygen increases its oxidation state.
- C) In oxidation process some elements change their oxidation state.
- D) In oxidation process some elements experience oxidation state increase.
- E) In oxidation process all elements change oxidation state.

Answer: D

15) Among the following reactions, find those that are redox reactions:

- 1) $\text{MnO}_4^- (\text{aq}) + 5 \text{Fe}^{2+} (\text{aq}) + 8 \text{H}^+ \rightarrow 5 \text{Fe}^{3+} (\text{aq}) + \text{Mn}^{2+} (\text{aq}) + 4 \text{H}_2\text{O}(\text{l})$
- 2) $6 \text{HF} + \text{Al}(\text{OH})_3 + 3 \text{NaOH} \rightarrow \text{Na}_3\text{AlF}_6 + 6 \text{H}_2\text{O}$
- 3) $\text{Au}(\text{s}) + 4 \text{H}^+ + \text{NO}_3^- + 4 \text{Cl}^- \rightarrow [\text{AuCl}_4]^- + 2 \text{H}_2\text{O} + \text{NO}(\text{g})$
- 4) $\text{FeS} + 2 \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S}$
- 5) $\text{SiO}_2 + 4 \text{HF} \rightarrow \text{SiF}_4 + \text{H}_2\text{O}$

- A) reaction 2)
- B) reactions 1) and 3)
- C) reaction 1)
- D) reaction 4)
- E) reactions 2) and 5)

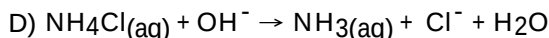
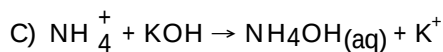
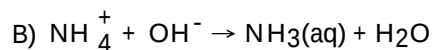
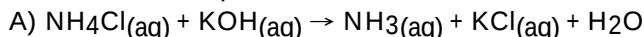
Answer: B

16) A solution is 0.660 M in HNO_3 and 1.02 M in $\text{Ca}(\text{NO}_3)_2$. What is the molarity of NO_3^- in the solution?

- A) 1.68 M
- B) 0.360 M
- C) 1.02 M
- D) 2.70 M
- E) 0.660 M

Answer: D

17) Write the net ionic equation for the reaction of ammonium chloride and potassium hydroxide.



E) no reaction

Answer: B

18) To increase the volume of a fixed amount of gas from 100 cm^3 to 200 cm^3 :

- A) reduce the temperature from 400 K to 200 K at constant pressure
- B) reduce the pressure from 608 mm Hg to 0.40 atm at constant temperature
- C) increase the pressure from 1.00 to 2.00 atm at constant temperature
- D) decrease the temperature from 600 K to 400 K
- E) increase the temperature from 25.0 to 50.0°C at constant pressure

Answer: B

19) The relationship between the "absolute temperature" on the Kelvin scale and the Celsius temperature is given by:

- A) $t(^{\circ}\text{C}) = 98.6 + T(\text{K})$
- B) $t(^{\circ}\text{C}) = T(\text{K}) + 273.15$
- C) $T(\text{K}) = t(^{\circ}\text{C}) + 273.15$
- D) $T(\text{K}) = 5/8[t(^{\circ}\text{C})] - 32$
- E) $T(\text{K}) = 8/5[t(^{\circ}\text{C})] + 32$

Answer: C

20) The statement, "For a fixed mass of gas at constant temperature, gas volume is inversely proportional to gas pressure." is known as:

- A) Boyle's Law
- B) Avogadro's Law
- C) Charles' Law
- D) Kelvin's Law
- E) Graham's Law

Answer: A

21) Of the following values, the most likely to be observed for the volume of 1.00 mole of He(g) at 0°C and 1000 atm is:

- A) 46 mL
- B) 17.4 mL
- C) 22.4 mL
- D) 22.4 L
- E) 11.2 mL

Answer: C

22) Assuming ideal gas behavior, which of the following gases would have the lowest density at standard temperature and pressure?

- A) CO₂
- B) SF₆
- C) Kr
- D) CF₂Cl₂
- E) N₂

Answer: E

23) What volume of acetylene gas, C₂H₂, would be required at 0°C and 1 atm to obtain a 200.0 g C₂H₂ sample?

- A) 320.0 L
- B) 1.309×10^5 L
- C) 172.1 L
- D) 4480 L
- E) 0.6304 L

Answer: C

24) What volume would be occupied by 4.8 g of oxygen gas at 0.50 atm and 133°C?

- A) 13 L
- B) 10 L
- C) 6.7 L
- D) 19 L
- E) 3.3 L

Answer: B

25) Of the following gases, the one with the greatest density at STP is:

- A) Ne
- B) He
- C) H₂
- D) NH₃
- E) CH₄

Answer: A

26) When one volume of CO reacts with one volume of Cl₂ phosgene is obtained as the only product. What is empirical formula of phosgene?

- A) C₂O₂Cl₂
- B) C₂O₂Cl
- C) COCl₄
- D) C₃O₃Cl₂
- E) COCl₂

Answer: E

27) Subtracting the vapor pressure of water from the total pressure of a gas collected over water is an example of the application of:

- A) ideal gas law
- B) Avogadro's Hypothesis
- C) Graham's Law
- D) van der Waals Theory
- E) Dalton's Law

Answer: E

28) The addition of 2.0 g He(g) to a vessel of 10.0 L fixed volume already containing $\text{O}_2(\text{g})$ at 25°C and 740 mmHg will:

- A) cause the final pressure to exceed 4 atm
- B) produce a 20% increase in gas pressure
- C) bring the final pressure to just slightly more than 1 atm
- D) cause the final pressure to exceed 2 atm
- E) have no effect on the final gas pressure

Answer: D

29) Calculate u_{rms} , in m/s, for $\text{H}_2(\text{g})$ molecules at 30°C .

- A) 6.09×10^2 m/s
- B) 1.94×10^3 m/s
- C) 5.26×10^3 m/s
- D) 2.74×10^3 m/s
- E) 6.12×10^1 m/s

Answer: B

30) Which of the following is a characteristic of an ideal gas?

- A) Individual gas particles occupy fixed volume.
- B) Gas cannot be compressed infinitely.
- C) Inter-particle forces are prominent.
- D) Collisions between gas particles are perfectly elastic
- E) Collisions between gas particles and container walls are not elastic

Answer: D

31) According to the kinetic-molecular theory of gases:

- A) at constant temperature, average kinetic energy is a function of gas volume
- B) the faster a given particle is moving, the greater its translational kinetic energy
- C) at constant temperature, all particles have equal translational kinetic energy
- D) all interparticle collisions are completely inelastic
- E) gaseous particles are in constant, nonlinear motion

Answer: B

32) If someone were to light a cigar at one end of a closed room, persons at the other end of the room might soon perceive an odor due to gaseous emissions from the cigar. Such a phenomenon is an example of:

- A) effusion
- B) ideality
- C) barometry
- D) diffusion
- E) monometry

Answer: D

33) Under conditions for which chlorine gas has an effusion rate of 2.4×10^{-6} mol/sec, what would be the effusion rate for bromine gas, in mol/sec?

- A) 5.4×10^{-6} mol/sec
- B) 1.6×10^{-6} mol/sec
- C) 3.6×10^{-6} mol/sec
- D) 1.1×10^{-6} mol/sec
- E) 2.3×10^{-6} mol/sec

Answer: B

34) The mutual attraction of gas molecules is an important aspect of:

- A) Dalton's Law
- B) Graham's Law
- C) van der Waals Theory
- D) Avogadro's Hypothesis
- E) ideal gas law

Answer: C

35) Gases tend to behave ideally at:

- A) low temperature and low pressure
- B) high temperature and low pressure
- C) low temperature and high pressure
- D) gases always behave ideally
- E) high temperature and high pressure

Answer: B

36) Choose the INCORRECT statement.

- A) Work is done when a force acts through a distance.
- B) The surroundings are the part of the universe that is studied.
- C) Chemical energy is associated with chemical bonds and intermolecular forces.
- D) Energy is the capacity to do work.
- E) Thermal energy is energy associated with random molecular motion.

Answer: B

37) 1219 joules of heat raise the temperature of 250 g of metal by 64°C. What is the specific heat in J/(g °C)?

- A) (1219)(250)(64) J/(g°C)
- B) (64)(250/1219) J/(g°C)
- C) (1219)(64/250) J/(g°C)
- D) (1219)/(250 × 64) J/(g°C)
- E) (1219)(250/64) J/(g°C)

Answer: D

38) What is the work done in joules by the system when H₂ expands against a constant pressure of 75 atm at 45.3°C? The change in volume is 24.0 L.

- A) -8.2×10^4 J
- B) 8.2×10^4 J
- C) 1.8×10^5 J
- D) -1.8×10^5 J
- E) 1.8×10^3 J

Answer: D

39) Which of the following are thermodynamic state functions?

- I) heat
- II) volume
- III) temperature
- IV) enthalpy
- V) density

- A) II, IV
- B) I, III, V
- C) I, II, IV, V
- D) I, II, III, V
- E) II, III, IV, V

Answer: E

40) A system absorbs 623 J of heat while doing 457 J of work. What is the value of ΔU ?

- A) +623 J
- B) -166 J
- C) -1080 J
- D) +166 J
- E) +1080 J

Answer: D

41) Enthalpy is defined as:

- A) the energy contained within a system
- B) the work not limited to pressure volume work
- C) the heat of combustion
- D) the sum of the kinetic and potential energies
- E) the sum of the internal energy and the pressure-volume product of a system

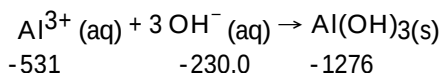
Answer: E

42) Calculate the work needed to make room for products in the combustion of sulfur, $S_8(s)$, to $SO_2(g)$ at STP.

- A) -18.2 kJ
- B) 0 kJ
- C) -2.27 kJ
- D) -4.54 kJ

Answer: B

43) Calculate the enthalpy change for the following reaction at 25°C. The value of ΔH°_f in kJ/mol is given below each species:



- A) -55 kJ
- B) -975 kJ
- C) -515 kJ
- D) -2040 kJ
- E) -1120 kJ

Answer: A

44) An example of a fossil fuel is:

- A) natural gas
- B) the sun
- C) carbon dioxide
- D) chlorophyll
- E) water

Answer: A

45) Coal contains an impurity that reacts with oxygen during the combustion process, producing oxides that are major environmental pollutants. This impurity is:

- A) nitrogen
- B) sulfur
- C) acid rain
- D) carbon dioxide
- E) peat

Answer: B

46) How much heat is needed to raise the temperature of 5.28 gal of water from 25.0°C to 88.0°C (1 gal = 3.785 L)?

- A) 133 kJ
- B) 997 kJ
- C) 5260 kJ
- D) 316 kJ
- E) 1390 kJ

Answer: C

47) How much heat is required to raise the temperature of 175 g of aluminum from 21.0°C to 145°C? The specific heat of aluminum is $0.903 J g^{-1} ^\circ C^{-1}$.

- A) 22.9 kJ
- B) 19.6 kJ
- C) 1.27 J
- D) 24.0 kJ

Answer: B

48) 100.0 g of Cu (specific heat = $0.385 J/g ^\circ C$) at 100.0°C is added to 140.0 mL of H_2O (specific heat = $4.184 J/g ^\circ C$) at 25.0°C.

What is the final temperature of the mixture?

- A) 91.4 °C
- B) 62.5 °C
- C) 33.7 °C
- D) 29.6 °C
- E) 56.3 °C

Answer: D

49) If 356 J of work is done by a system while it loses 289 J of heat, what is the value of ΔU (Internal Energy) ?

A) +645 J

B) +134 J

C) -645 J

D) +67 J

E) -67 J

Answer: C

50) A certain reaction releases 10.1 kJ at constant volume and at constant pressure releases 8.4 kJ. What is ΔU (Internal Energy) for the reaction?

A) +8.4 kJ

B) -1.7 kJ

C) -10.1 kJ

D) -8.4 kJ

Answer: C