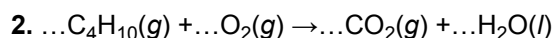


SAT Chemistry Practice Paper 7

SET 1

What is the number of protons and neutrons in an atom with mass number 89 and atomic number 39?

- A. 50 protons and 50 neutrons
- B. 50 protons and 39 neutrons
- C. 39 protons and 89 neutrons
- D. 39 protons and 50 neutrons
- E. 39 protons and 39 neutrons



When the above equation is balanced using the lowest whole-number terms, the coefficient of  $\text{CO}_2$  is

- A. 2
- B. 4
- C. 8
- D. 10
- E. 13

3. Which of the following is closest in mass to a proton?

- A. Alpha particle
- B. Positron
- C. Neutron
- D. Electron
- E. Hydrogen molecule

4. What is the approximate percentage composition by mass of the element oxygen in the compound  $\text{HClO}_4$ ?

- A. 16%
- B. 32%
- C. 50%
- D. 64%
- E. 75%

5. If two atoms that differ in electronegativity combine by chemical reaction and share electrons, the bond that joins them will be

- A. metallic
- B. ionic
- C. a hydrogen bond
- D. nonpolar covalent
- E. polar covalent

6. When the temperature of a 20-gram sample of water is increased from 10°C to 30°C, the heat transferred to the water is

- A. 600 calories
- B. 400 calories
- C. 200 calories
- D. 30 calories
- E. 20 calories

7. What is the oxidation state of chromium, Cr, in the compound potassium dichromate,  $K_2Cr_2O_7$ ?

- A. 1
- B. 2
- C. 3
- D. 6
- E. 12

8. An aqueous solution with pH 5 at 25°C has a hydroxide ion ( $OH^-$ ) concentration of

- A.  $1 \times 10^{-11}$  molar
- B.  $1 \times 10^{-9}$  molar
- C.  $1 \times 10^{-7}$  molar
- D.  $1 \times 10^{-5}$  molar
- E.  $1 \times 10^{-3}$  molar

9.  $2H_2O(g) \rightarrow 2H_2(g) + O_2(g)$

The volume of water vapor required to produce 44.8 liters of oxygen by the above reaction is

- A. 11.2 liters
- B. 22.4 liters

- C. 44.8 liters
- D. 89.6 liters
- E. 100.0 liters

10. When 190 grams of  $\text{MgCl}_2$  are dissolved in water and the resulting solution is 500 milliliters in volume, what is the molar concentration of  $\text{MgCl}_2$  in the solution?

- A. 2.0 M
- B. 4.0 M
- C. 8.0 M
- D. 12.0 M
- E. 16.0 M

11. When a fixed amount of gas has its Kelvin temperature doubled and its pressure doubled, the new volume of the gas is

- A. four times greater than its original volume
- B. twice its original volume
- C. unchanged
- D. one-half its original volume
- E. one-fourth its original volume

12. In 12.4 hours, a 100 gram sample of an element decays so that its mass is 25 grams. What is the approximate half-life of this radioactive substance?

- A. 1.6 hours
- B. 3.1 hours
- C. 6.2 hours
- D. 24.8 hours
- E. 49.6 hours

13. In the equation  $Q \rightarrow {}^4_2\text{He} + {}^{216}_{85}\text{At}$ , the species represented by Q is

- A.  ${}^{220}_{87}\text{Fr}$
- B.  ${}^{212}_{83}\text{Bi}$
- C.  ${}^{220}_{87}\text{At}$

D.  ${}^{212}_{83}\text{Fr}$

E.  ${}^{216}_{85}\text{Bi}$

14. A compound with a molecular weight of 56 amu has an empirical formula of  $\text{CH}_2$ . What is its molecular formula?

A.  $\text{C}_2\text{H}_2$

B.  $\text{C}_2\text{H}_4$

C.  $\text{C}_4\text{H}_8$

D.  $\text{C}_4\text{H}_{10}$

E.  $\text{C}_6\text{H}_{12}$

15. The change in heat energy for a reaction is best expressed as a change in

A. enthalpy

B. absolute temperature

C. specific heat

D. entropy

E. kinetic energy

16.  $\dots\text{NF}_3(g) + \dots\text{H}_2\text{O}(g) \rightarrow \dots\text{HF}(g) + \dots\text{NO}(g) + \dots\text{NO}_2(g)$

When the equation for the reaction above is balanced, how many moles of  $\text{NF}_3$  would be required to react completely with 6 moles of  $\text{H}_2\text{O}$ ?

A. 0.5 mole

B. 1 mole

C. 2 moles

D. 3 moles

E. 4 moles

17. Which characteristic is associated with bases?

A. React with metal to produce hydrogen gas

B. Donate an unshared electron pair

C. Always contain the hydroxide ion in their structure

D. Taste sour

E. Formed by the reaction of a nonmetal oxide and water

**18.** An element has the following properties: shiny, brittle, poor electrical conductivity, and high melting point. This element can be best classified as a(n)

A. alkali metal

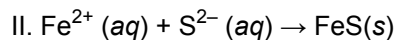
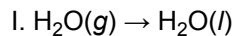
B. halogen

C. metalloid

D. transition metal

E. noble gas

**19.** Which of the following forward processes produces a decrease in entropy?



A. I only

B. III only

C. I and II only

D. II and III only

E. I, II, and III

**20.** Which of the following will raise the boiling point of a sample of water?

A. Heat the water

B. Mix gasoline into the water

C. Bring the water sample to a higher altitude

D. Place the water sample on a magnetic stirrer

E. Dissolve table sugar into the water

**21.** Elements H and J lie in the same period. If the atoms of H are smaller than the atoms of J, then compared to atoms of J, atoms of H are most likely to

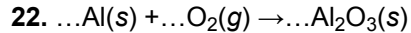
A. exist in a greater number of isotopes

B. exist in a lesser number of isotopes

C. exist in a greater number of oxidation states

D. have a greater positive charge in their nuclei

E. have a lesser positive charge in their nuclei



When the equation representing the reaction shown above is completed and balanced and all coefficients are reduced to lowest whole-number terms, the coefficient of  $\text{O}_2(g)$  is

- A. 1
- B. 2
- C. 3
- D. 4
- E. 6

23. Which of the following solids has a brilliant blue color?

- A.  $\text{Ca}(\text{OH})_2$
- B.  $\text{KCl}$
- C.  $\text{NaBr}$
- D.  $\text{Fe}_2\text{O}_3$
- E.  $\text{CuSO}_4$

#### SET 2

Twenty-five percent of element X exists as  $^{210}\text{X}$  and 75 percent of it exists as  $^{214}\text{X}$ . What is the atomic weight of element X in amu?

- A. 85
- B. 211
- C. 212
- D. 213
- E. 214

2. A 600-milliliter container holds 2 moles of  $\text{O}_2(g)$ , 3 moles of  $\text{H}_2(g)$ , and 1 mole of  $\text{He}(g)$ . Total pressure within the container is 760 torr. What is the partial pressure of  $\text{O}_2$ ?

- A. 127 torr
- B. 253 torr
- C. 380 torr

D. 507 torr

E. 760 torr



The ionic solid  $\text{Fe}(\text{OH})_3$  is added to water and dissociates into its component ions, as shown above. The solubility product expression for the saturated solution is

A.  $K_{sp} = [\text{Fe}^{3+}][\text{OH}^{-}]$

B.  $K_{sp} = [\text{Fe}^{3+}][3\text{OH}^{-}]$

C.  $K_{sp} = [\text{Fe}^{3+}][3\text{OH}^{-}]^3$

D.  $K_{sp} = [\text{Fe}^{3+}][\text{OH}^{-}]^3$

E.  $K_{sp} = \frac{[\text{Fe}^{3+}][\text{OH}^{-}]^3}{[\text{Fe}(\text{OH})_3]}$

4. Which of the following electron configurations represents an atom of magnesium in an excited state?

A.  $1s^2 2s^2 2p^6$

B.  $1s^2 2s^2 2p^6 3s^2$

C.  $1s^2 2s^2 2p^5 3s^2 3p^2$

D.  $1s^2 2s^2 2p^6 3s^1 3p^1$

E.  $1s^2 2s^2 2p^6 3s^1 3p^2$

5. All of the following when added to water will produce an electrolytic solution EXCEPT

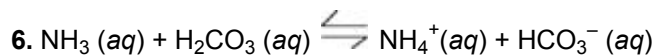
A.  $\text{N}_2(\text{g})$

B.  $\text{HCl}(\text{g})$

C.  $\text{KOH}(\text{s})$

D.  $\text{NaI}(\text{s})$

E.  $\text{CaCl}_2(\text{s})$



In the reaction represented above,  $\text{NH}_4^{+}$  acts as a(n)

A. indicator

B. hydrate

C. acid

D. base

E. salt

7. Which species has the ground state electron configuration  $1s^2 2s^2 2p^6 3s^2 3p^6$ ?

A. Sulfide ion,  $S^{2-}$

B. Bromide ion,  $Br^-$

C. Neon atom, Ne

D. Chromium ion,  $Cr^{3+}$

E. Potassium atom, K

8. Which of the following species is amphoteric?

A.  $Na_3PO_4$

B.  $HSO_4^-$

C. KOH

D.  $HNO_3$

E.  $C_2O_4^{2-}$

9. An ideal gas has a volume of 10 liters at  $20^\circ C$  and a pressure of 750 mmHg. Which of the following expressions is needed to determine the volume of the same amount of gas at STP?

A.  $10 \times \frac{750}{760} \times \frac{0}{20} \text{ L}$

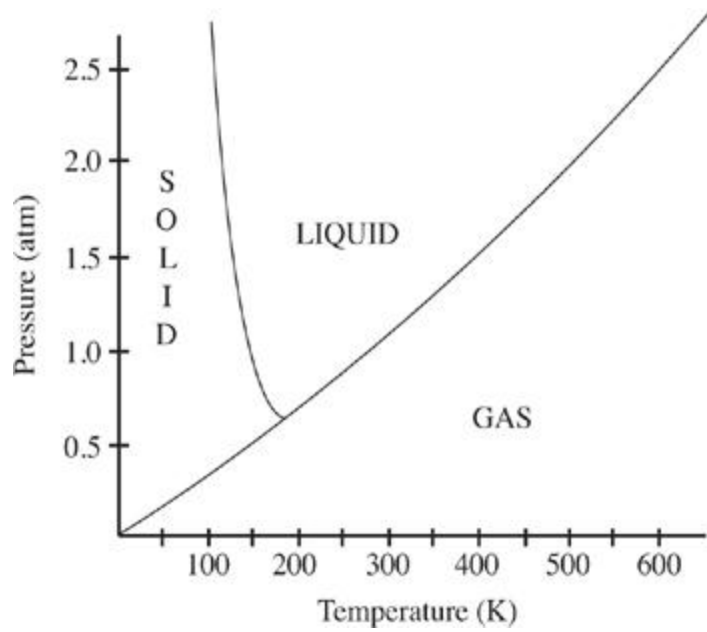
B.  $10 \times \frac{750}{760} \times \frac{293}{273} \text{ L}$

C.  $10 \times \frac{760}{750} \times \frac{0}{20} \text{ L}$

D.  $10 \times \frac{760}{750} \times \frac{273}{293} \text{ L}$

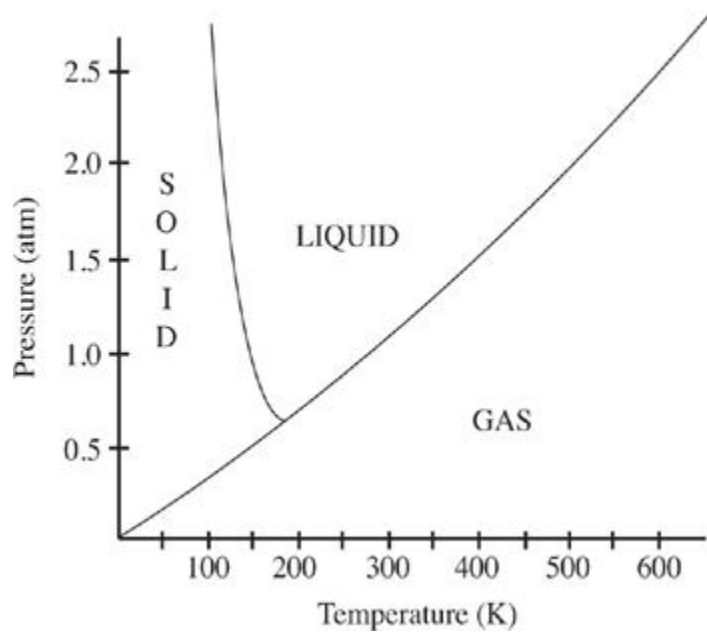
E.  $10 \times \frac{750}{760} \times \frac{273}{293} \text{ L}$





10. Substance Z is at 0.5 atm and 200 K. If the pressure on substance Z is steadily increased and its temperature is kept constant, what phase change will eventually occur?

- A. Condensation
- B. Freezing
- C. Melting
- D. Sublimation
- E. Vaporization



11. The normal boiling point of substance Z is closest to

- A. 100 K
- B. 200 K
- C. 300 K
- D. 400 K
- E. 500 K

12. The shape of a  $\text{PCl}_3$  molecule is described as

- A. bent
- B. trigonal pyramidal
- C. linear
- D. trigonal planar
- E. tetrahedral

13. What volume of 0.4 M  $\text{Ba}(\text{OH})_2$  (aq) is needed to exactly neutralize 100 milliliters of 0.2 M  $\text{HBr}$ (aq)?

- A. 25 mL
- B. 50 mL
- C. 100 mL
- D. 200 mL
- E. 400 mL

14. Which of the following is true regarding the aqueous dissociation of  $\text{HCN}$ ,  $K_a = 4.9 \times 10^{-10}$  at  $25^\circ\text{C}$ ?

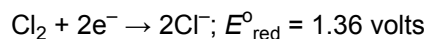
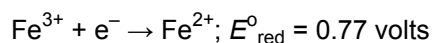
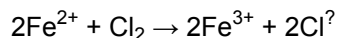
- I. At equilibrium,  $[\text{H}^+] = [\text{CN}^-]$
- II. At equilibrium,  $[\text{H}^+] > [\text{HCN}]$
- III.  $\text{HCN}(\text{aq})$  is a strong acid.

- A. I only
- B. II only
- C. I and II only
- D. II and III only
- E. I, II, and III

15. Which of the following atoms has the largest second ionization energy?

- A. Silicon, Si
- B. Calcium, Ca
- C. Chlorine, Cl
- D. Iron, Fe
- E. Sodium, Na

**16. Question below** refers to the overall reaction and half-reactions with standard reduction potentials below.

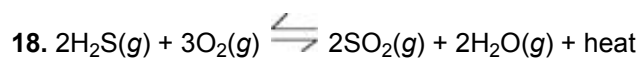


62. The standard potential difference of an electro-chemical cell using the overall reaction above is

- A. 0.18 volts
- B. 0.59 volts
- C. 1.05 volts
- D. 2.13 volts
- E. 2.90 volts

**17.** The reaction of zinc metal, Zn, and hydrochloric acid, HCl, produces which of the following?

- I.  $\text{H}_2(g)$
  - II.  $\text{Cl}_2(g)$
  - III.  $\text{Zn}^{2+}(aq)$
- A. II only
  - B. III only
  - C. I and II only
  - D. I and III only
  - E. I, II, and III



For the above reaction, the equilibrium concentration of  $\text{SO}_2(g)$  can be increased by

- A. adding neon gas

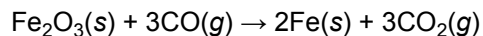
- B. increasing the temperature
- C. adding a catalyst
- D. increasing the concentration of  $\text{H}_2\text{O}(g)$
- E. increasing the concentration of  $\text{O}_2(g)$



Which of the following is increased by decreasing the volume of the reaction system?

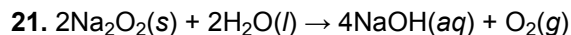
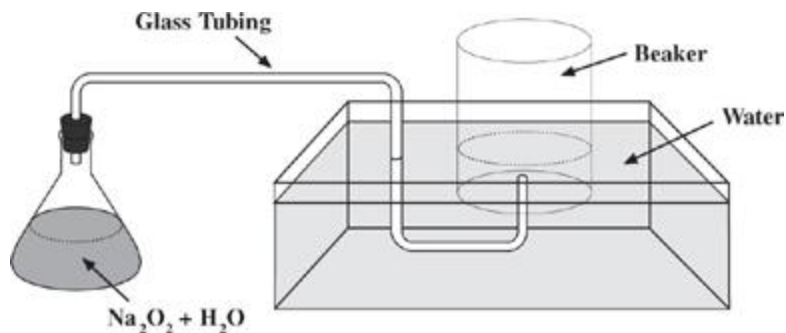
- I. Rate of reaction
- II. Equilibrium concentration of reactants
- III. Value of  $K_{eq}$

- A. I only
- B. III only
- C. I and II only
- D. II and III only
- E. I, II, and III



When 3 moles of  $\text{Fe}_2\text{O}_3$  are allowed to completely react with 56 grams of CO according to the above equation, approximately how many moles of iron, Fe, are produced?

- A. 0.7
- B. 1.3
- C. 2
- D. 2.7
- E. 6

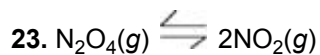


Sodium peroxide,  $\text{Na}_2\text{O}_2$ , and water react in the flask at  $25^\circ\text{C}$  according to the equation and in the diagram above. If water levels are equal inside and outside the beaker, then the gas pressure inside the beaker is equal to the

- A. pressure of oxygen gas collected
- B. vapor pressure of water at  $25^\circ\text{C}$
- C. sum of pressure of oxygen gas collected and atmospheric pressure
- D. sum of vapor pressure of water at  $25^\circ\text{C}$  and atmospheric pressure
- E. sum of pressure of oxygen gas collected and vapor pressure of water at  $25^\circ\text{C}$

22. Which of the following molecules has the strongest carbon-to-carbon bond?

- A.  $\text{C}_2\text{H}_2$
- B.  $\text{C}_2\text{H}_4$
- C.  $\text{C}_2\text{H}_6$
- D.  $\text{C}_3\text{H}_8$
- E.  $\text{C}_4\text{H}_{10}$



The following concentration data were gathered for the above reaction at 5 minute intervals from the start of an experiment:

Time After Start of Experiment	$[\text{N}_2\text{O}_4]$	$[\text{NO}_2]$
??0 min (start)	0.00 M	0.50 M
??5 min	0.10 M	0.33 M

10 min	0.20 <i>M</i>	0.20 <i>M</i>
15 min	0.25 <i>M</i>	0.15 <i>M</i>
20 min	0.28 <i>M</i>	0.13 <i>M</i>
25 min	0.28 <i>M</i>	0.13 <i>M</i>

If the experiment was carried out in a closed system at constant temperature, then during which time interval (from the start of the experiment) did the reaction most likely achieve equilibrium?

- A. 0 min (start) to 5 min
- B. 5 min to 10 min
- C. 10 min to 15 min
- D. 15 min to 20 min
- E. 20 min to 25 min