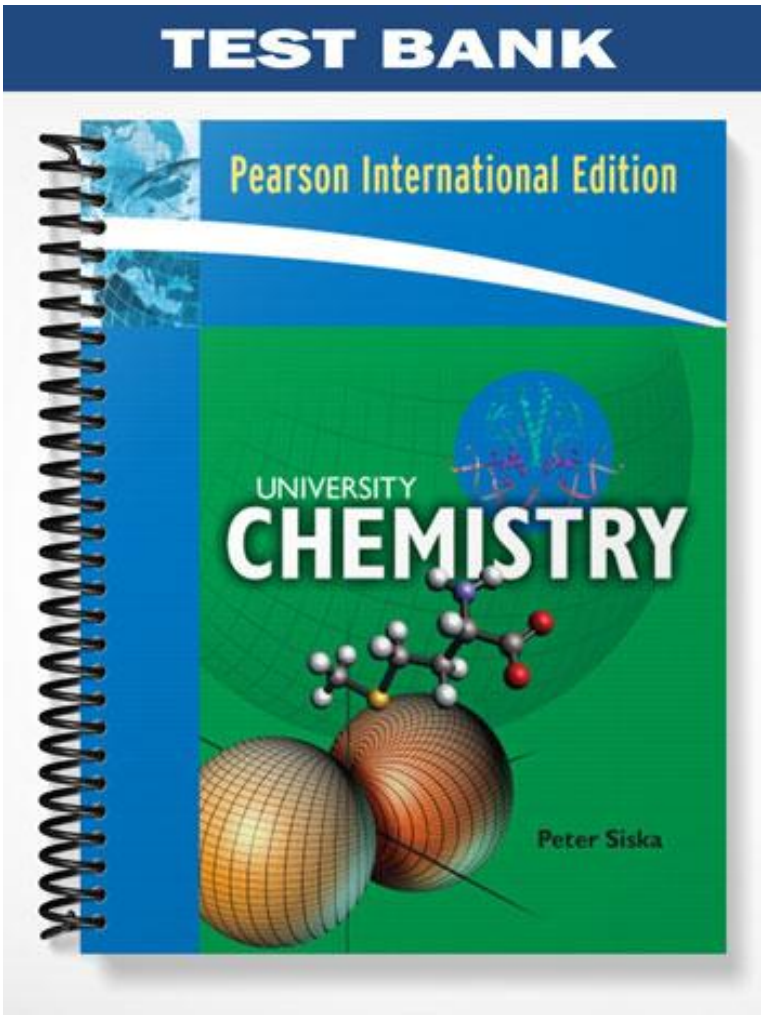
TEST BANK
Pearson International Edition
UNIVERSITY
CHEMISTRY
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University Chemistry (Siska)
Chapter 1

1) For the following reaction, 3.36 g $NaHCO_3$ was reacted with 20.0 mL of 1.00 M HCl. What volume of $CO_2(g)$ is produced in L at STP?

$HCl(aq) + NaHCO_3(s) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

A) 8.93×10^{-4} L
B) 0.896 L
C) 0.448 L
D) 1.79×10^{-3} L

Answer: C
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

2) For the reaction between $Al(s)$ and $H_2SO_4(aq)$, suppose that 5.40 g $Al(s)$ is reacted with 50.0 mL of 1.50 M $H_2SO_4(aq)$. Calculate the amount in grams of aluminum sulfate that is formed.

A) 8.55 g
B) 25.7 g
C) 85.5 g
D) 4.05 g

Answer: A
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

3) A 0.0125 L sample of H_2SO_4 (sulfuric acid) is titrated with 0.0394 L of 0.2697 M NaOH. What is the concentration in mols/L of the sulfate ion SO_4^{2-} at the moment 0.0394 L of the NaOH was added? Your answer must contain the *maximum* number of significant figures that the data allow.

A) 0.1024 M
B) 0.102 M
C) 0.205 M
D) 0.2047 M

Answer: B
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

4) A 5.78 L balloon at STP contains a 1:1 ratio by volume of $H_2(g)$ and $O_2(g)$. The mixture is sparked, and the explosive water forming reaction proceeds. What mass in grams of water is formed?

A) 1.17×10^3 g
B) 2.33×10^3 g
C) 1.16 g
D) 2.32 g

Answer: D
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

5) You need to make oxygen by decomposing $KClO_3$ according to

$KClO_3(s) \rightarrow KCl(s) + O_2(g)$. (not balanced)

What volume of $O_2(g)$ can you generate at STP if you have 5.22 g of $KClO_3(s)$?

A) 0.954 L
B) 2.85×10^{-3} L
C) 1.43 L
D) 1.90×10^{-3} L

Answer: C
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

6) Use Avogadro's Principle ($V \propto N$) to determine the volume (cubic meters) of air you need to collect at STP so that you can extract 0.450 g of neon. Air is 0.00182 mole % Ne at STP.

A) 27.4 m^3
B) 2.74×10^5 m^3
C) 2.74 m^3
D) 274 m^3

Answer: A
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

7) The mass spectrum of $Br_2(g)$ shows three peaks at mass numbers 158, 160, and 162. Predict the relative peak heights by using the % abundance for the only two isotopes of Br:

^{79}Br: 50.69 % ^{81}Br: 49.31 %.

The relative peak heights for the peaks at 158, 160, and 162 are, respectively,

A) 0.5069 : 0.2888 : 0.4931.
B) 0.1690 : 0.6666 : 0.1644.
C) 0.8009 : 0.8064 : 0.7988.
D) 0.2569 : 0.4999 : 0.2431.

Answer: D
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

8) How many kilograms of benzene, C_6H_6, can be made from the carbon atoms that are present in a sample of C_2H_6 that has a volume of 17.42 m^3 at STP?

A) 1.016×10^4 kg
B) 20.25 kg
C) 10.13 kg
D) 10.16×10^2 kg

Answer: B
Topic: Reaction stoichiometry
Skill: Quantitative Multiple Choice Questions

9) A typical solid protein sample has a density of 0.830 g/cm^3, composed of globular (roughly spherical) protein molecules with an average molecular mass of 2.00×10^4 amu. What is the estimated diameter of this protein in Å?

A) 3.02×10^{-7} Å
B) 4.00×10^{-20} Å
C) 3.02 Å
D) 34.2 Å

Answer: D
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

10) A roll of aluminum foil, assumed to be 100 % Al metal, is 0.0200 mm thick, 30.4 cm wide, and 22.8 m long. Its mass is 374 g. Estimate the diameter of an aluminum atom in Å
A) 2.55 Å
B) 1.66 Å
C) 8.35 Å
D) 2.03 Å

Answer: A
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

11) Given that silver has two isotopes, ^{107}Ag and ^{109}Ag, determine the fractional abundance of each if their masses are 106.905 and 108.905 amu, respectively.
A) ^{107}Ag: 0.482 ^{109}Ag: 0.518
B) ^{107}Ag: 0.518 ^{109}Ag: 0.482
C) ^{107}Ag: 0.500 ^{109}Ag: 0.500
D) ^{107}Ag: 48.2 ^{109}Ag: 51.8

Answer: B
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

12) Assuming that the mechanical energy of a gaseous chlorine molecule is entirely kinetic, estimate its velocity in cm/s at T = 22.0 °C.
A) 1.07×10^{-11} cm/s
B) 1.07×10^{-9} cm/s
C) 2.63×10^{4} cm/s
D) 8.32×10^{2} cm/s

Answer: C
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

13) Express in Coulombs the total negative charge contained in a 4.09 g chunk of bismuth Bi.
A) 1.89×10^{3} C
B) 1.57×10^{5} C
C) 5.11×10^{3} C
D) 5.29×10^{-4} C

Answer: B
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

14) How much energy in eV is required to raise the temperature of 1.00 L of water by 5.0 °C?
A) 4.55×10^{-15} eV
B) 5.00×10^{4} eV
C) 8.11×10^{23} eV
D) 1.3×10^{23} eV
Answer: D
Topic: Estimates and Avogadro's number
Skill: Quantitative Multiple Choice Questions

15) A free electron with a kinetic energy of 12.0 eV in a helium discharge tube passes within 2.40×10^{-10} m of a He^{2+} ion. What is the kinetic energy in eV of the electron at this distance from the He^{2+} ion?
A) 30.0 eV
B) 24.0 eV
C) 12.0 eV
D) 0 eV; The electron has stopped.
Answer: B
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

16) To estimate the potential energy of interaction in eV between an aluminum ion Al^{3+} and a water molecule, treat H_2O as a linear dipole with partial charges of - 0.88*e* and + 0.88*e*. The charges are separated along a line as follows:

$$Al^{3+} \text{ -------- } \underset{R}{O^{-0.88}} \text{ -------- } \underset{r}{H_2^{+0.88}},$$

where R = 1.90 Å and r = 0.44 Å. (Since they are in the same dipole, do not consider any interaction between the two ends of the water molecule with each other.) The estimated potential energy of interaction is
A) - 1.25 eV.
B) - 36.3 eV.
C) - 0.322 eV.
D) - 3.76 eV.
Answer: D
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

17) Hooke's Law of Springs can be written as $F = -k(r - r_e)$. Once integrated, this formula provides the potential energy that is created when the spring is stretched from its equilibrium position. Consider a molecule of HCN for which k = 580 N/m for the C-H bond. Assuming that this bond can be approximated by Hooke's Law, how much kinetic energy in eV will a hydrogen atom have when it returns to r_e if it had been stretched 0.15 Å from r_e prior to being released?
A) 6.5 eV
B) 44 eV
C) 0.41 eV
D) 0.97 eV
Answer: C
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

18) What potential energy in eV would the single electron of a Be^{3+} ion possess? Note that the nucleus/electron separation is 1.32×10^{-11} m.
A) - 545 eV
B) - 436 eV
C) 4.36×10^{12} eV
D) 2.80 eV
Answer: B
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

19) If we could place a helium nucleus a distance of 3.00×10^{-12} cm away from a platinum nucleus and allow the nuclei to fly apart, what is the maximum velocity that the helium nucleus could have? Assume that the helium nucleus inherits all of the potential energy that was initially available when the two nuclei were placed side by side. The mass of the helium nucleus is 4.00 amu.
A) 1.9×10^{7} m/s
B) 7.7×10^{-7} m/s
C) 1.9×10^{3} m/s
D) 5.9×10^{11} m/s
Answer: A
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

20) What is the Coulomb force in dynes between a Ba^{2+} ion and a S^{2-} ion that are separated by 1.46 Å?
A) $- 6.32 \times 10^{-11}$ dyne
B) $- 1.08 \times 10^{-3}$ dyne
C) $- 4.33 \times 10^{-3}$ dyne
D) $- 1.73 \times 10^{-2}$ dyne
Answer: C
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

21) Among the experiments that Rutherford and his students used to deduce the existence of the atomic nucleus was one in which α-particles (He^{2+}) were scattered from silver foil. What minimum kinetic energy in MeV would an α-particle need to penetrate to within 0.00200 Å of a silver nucleus? (Ignore the effects of the electrons in the silver atom.)
A) 35.2 MeV
B) 0.0470 MeV
C) 4.70×10^{4} MeV
D) 0.677 MeV
Answer: D
Topic: Coulomb's Law and kinetic and potential energy
Skill: Quantitative Multiple Choice Questions

22) The area under the curve of a force versus displacement graph is:
A) always negative.
B) work.
C) given by $- dV/dx$.
D) equal to $- k(r - r_e)^2$.
Answer: B
Skill: Qualitative Multiple Choice Questions

23) The mass defect is due to
A) the weighted average of the isotopes of a given element.
B) the unique structure of the ^{12}C isotope.
C) limitations of mass spectrometry.
D) conversion of nuclear mass into binding energy.
Answer: D
Skill: Qualitative Multiple Choice Questions

24) Newton's famous second law is
A) $F = -\,dp/dt$.
B) $F = m(dv^2/dt^2)$.
C) $F = m(d^2\,x/\,dt^2)$.
D) $F = \frac{1}{2}\,mv^2$.
Answer: C
Skill: Qualitative Multiple Choice Questions

25) If 2.0 L of hydrogen gas are reacted with excess solid carbon, what volume of C_2H_6 gas can be formed?
A) 0.67 L
B) 6.0 L
C) 2.0 L
D) 1.5 L
Answer: A
Skill: Qualitative Multiple Choice Questions

26) Potential energy exists *only* when
A) charged particles interact.
B) there is a force acting on the object of interest.
C) Newton's inverse-square law of force does not apply.
D) kinetic energy is zero.
Answer: B
Skill: Qualitative Multiple Choice Questions

27) Why does Maxwell's theory of electricity and magnetism predict atomic collapse of the electron into the nucleus, yet it does not predict planets collapsing into the sun?
A) The atom contains charged particles.
B) The kinetic energy of the electron is much less than that of a planet.
C) The distance between the bodies of interest is smaller in the atom.
D) The gravitational force acting between two bodies is of greater magnitude in the atom than in the solar system.
Answer: A
Skill: Qualitative Multiple Choice Questions

28) The Coulomb potential energy equation in cgs units is $V = q_1 q_2 / r$. What is the relationship between work and the potential energy between a proton and electron?

A) $$w = \int_{x_1}^{x_2} V dx$$

B) Since work is defined only in terms of force, no relationship exists.

C) The potential energy is equal to the work required to separate completely the electron from the nucleus.

D) The potential energy is equal to the negative of the work required to separate completely the electron from the nucleus.

Answer: D

Skill: Qualitative Multiple Choice Questions

29) On the surface the mks and cgs unit systems look vastly different. Their magnitudes and names, in particular, are quite different. Despite this, only one quantity is *fundamentally* different. This quantity is

A) momentum.

B) the speed of light.

C) charge.

D) force.

Answer: C

Skill: Qualitative Multiple Choice Questions

30) Joe is on the second story of a building. The floor of this story is a distance $3h$ above the ground where Peter stands. Joe raises a book of mass m a distance h from the floor and reports that the potential energy of the object is mgh. Peter disagrees and says that the potential energy is $4mgh$. Who is right?

A) Peter

B) both Peter and Joe

C) Joe

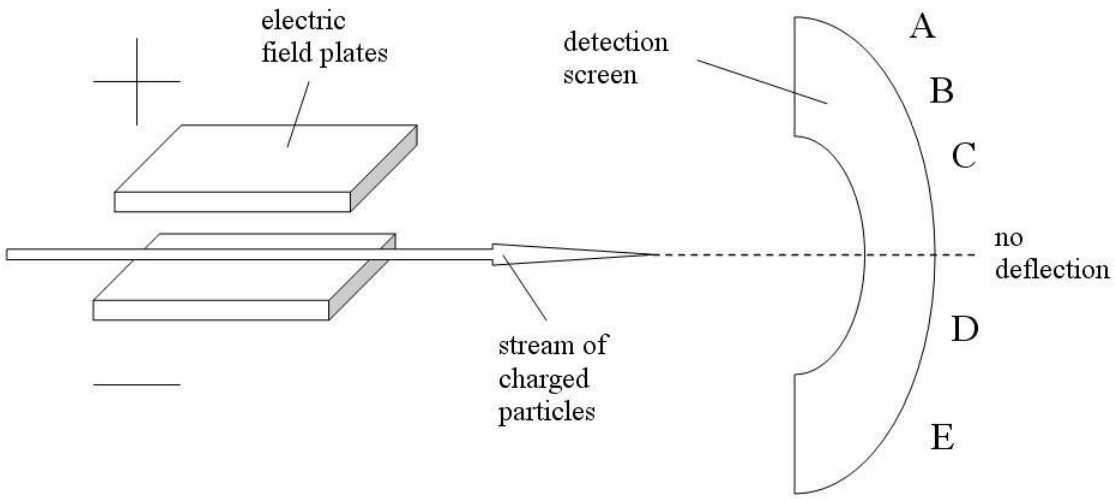
D) neither because the potential energy must be negative in this case

Answer: B

Skill: Qualitative Multiple Choice Questions

Short Answer Questions

A simplified, schematic drawing of J. J. Thomson's device for measuring the charge to mass ratio of ions or electrons is shown below. In a thought experiment we send a mixture of second row atoms (W, X, Y, Z) and electrons through the device. Match the location of each spot (A, B, C, D, E) on the detection screen with the particle that produced it. Note that mass(W) > mass(X) > mass(Y) > mass(Z).



31) W^{2+}
Answer: D

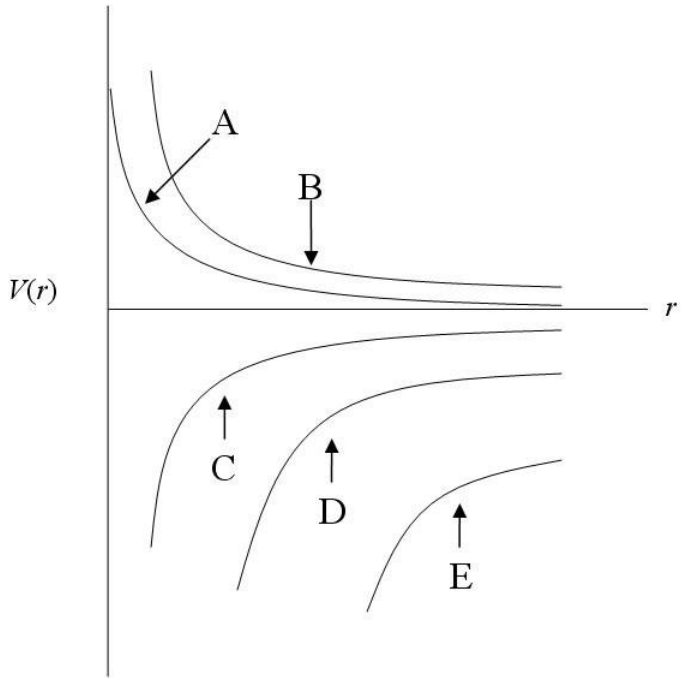
32) an electron
Answer: A

33) Y^{2-}
Answer: C

34) Z^{2-}
Answer: B

35) X^{2+}
Answer: E

Match each potential energy curve shown below with the interaction from which it arose. The curves are not quantitatively exact, but assignments can still be made.



36) electron-electron interaction
Answer: B

37) electron-beryllium nucleus interaction
Answer: E

38) electron-proton interaction
Answer: C

39) electron-helium nucleus interaction
Answer: D

40) an interaction of two particles each with a charge less than +*e*
Answer: A

41) Uniform circular motion results from _____ acceleration.
Answer: centripetal

42) Negative total energy indicates a _____ electron, whereas positive total energy indicates a _____ electron.
Answer: bound, free

43) The _____ difference - $\Delta V/\Delta r$ approximates F because F equals _____.
Answer: finite, - dV/dr

44) 100. mL of blood serum contains 10. mg of calcium in the form of Ca^{2+} ions. How many Ca^{2+} ions are present in a single drop, 0.040 mL?
Answer: 6.0×10^{16} ions

45) Verify Dalton's Law of Multiple Proportions by determining the ratio of the ratios of the combining masses, m_S/m_O, for SO_2 to SO_3. The ratio of the ratios is
Answer: 3/2.

46) Boron and chlorine both have two isotopes. This gives rise to _____ peaks in the mass spectrum of BCl_3. The most intense peak in the spectrum arises from the combination of the most _____ isotopes of each element.
Answer: eight, abundant

47) If a proton is accelerated through an electric potential difference of exactly two volts, the kinetic energy that the proton has acquired is _____.
Answer: 2 eV

48) A certain property of an electric field, the _____ potential, is measured in joules per coulomb.
Answer: electric

49) While modern atomic theory has proposed "pieces" of positive charge in the nucleus called quarks, the charge for which can be (2/3)e for example, no such fractional charge is thought to exist in the _____.
Answer: electron

50) After an object has minimized its potential energy as far as possible, it has reached a state called _____.
Answer: equilibrium

1) C

2) A

3) B

4) D

5) C

6) A

7) D

8) B

9) D

10) A

11) B

12) C

13) B

14) D

15) B

16) D

17) C

18) B

19) A

20) C

21) D

22) B

23) D

24) C

25) A

26) B

27) A

28) D

29) C

30) B

31) D

32) A

33) C

34) B

35) E

36) B

37) E

38) C

39) D

40) A

41) centripetal

42) bound, free

43) finite, - dV/dr

44) 6.0×10^{16} ions

45) 3/2.

46) eight, abundant

47) 2 eV

48) electric

49) electron

50) equilibrium