

Lab Equipment Pop Quiz

- 1) Heating a chemical to a temperature of 1500°C requires the following equipment (1.5 points each):
 - ring stand
 - ring
 - Bunsen burner
 - flint striker
 - clay triangle (or wire gauze)
 - crucible (or evaporating dish)
 - crucible tongs
 - goggles

- 2) The equipment which can accurately measure the volume of a liquid include (2 points each):
 - graduated cylinder
 - volumetric flask
 - volumetric pipet

- 3) To tell if a piece of glassware is too hot to touch, splash a little bit of water on it. If the water sizzles, the glassware is too hot to touch. This should be done whenever glassware has been heated over a Bunsen burner or hot plate. (3 points)

Suggested Grading Scale

21 = A+
19 – 20.5 = A
18 – 18.5 = B+
17 – 17.5 = B
16 – 16.5 = C+
15 – 15.5 = C
14 – 14.5 = D+
13 – 13.5 = D
<3 = F

Pop Quiz

Please answer all questions to the best of your abilities on a separate sheet of paper.

- 1) Describe all lab equipment which would be required if you wanted to heat a chemical to 1500°C . (12 points)
- 2) Describe all lab equipment that can be used to accurately measure the volume of a liquid. (6 points)
- 3) What should be done to determine if glassware is too hot to touch? (3 points)

Pop Quiz

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- 1) Describe all lab equipment which would be required if you wanted to heat a chemical to 1500°C . (12 points)
- 2) Describe all lab equipment that can be used to accurately measure the volume of a liquid. (6 points)
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- 1) Describe all lab equipment which would be required if you wanted to heat a chemical to 1500°C . (12 points)
- 2) Describe all lab equipment that can be used to accurately measure the volume of a liquid. (6 points)
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- 1) Describe all lab equipment which would be required if you wanted to heat a chemical to 1500°C . (12 points)
- 2) Describe all lab equipment that can be used to accurately measure the volume of a liquid. (6 points)
- 3) What should be done to determine if glassware is too hot to touch? (3 points)

Scientific Method Pop Quiz

Your students will have a wide variety of answers for this quiz, depending on the problems they cite in their use of the scientific method. However, this should be a straightforward quiz to grade because kids usually get the whole thing right or the whole thing wrong.

If your students mention the six steps of the scientific method (purpose, hypothesis, materials, procedure, results, conclusion), give them one point for each of them. If the steps are listed in order, give them an additional three points.

If your students correctly apply the six steps of the scientific method, give them one point for each step they get correct. For example, the hypothesis should be an "if ____, then ____" statement and the materials list should be complete for the question.

Suggested Grading Scale

15 = A+

14 = A

13 = B+

12 = B

11 = C+

10 = D+

9 = D

< 9 = F

Pop Quiz

Please answer this question on a separate sheet of paper.

The scientific method has been described in this class as being the way that scientists solve problems. However, the scientific method isn't only useful for scientists – it's useful for everybody.

For this quiz you will think back to an experience where you had a problem you needed to solve. List the six steps of the scientific method in order and use them to describe how you solved your problem.

Grading: 1 point for each step of the scientific method, 3 points for getting them in the right order, 1 point for your application of each step into your personal experiences.

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Elements, Compounds, and Mixtures Pop Quiz

- 1) A tuna sandwich is a heterogeneous mixture because the bread and tuna fish are easily distinguishable from one another. (1 point)
- 2) A silver bracelet is an element because silver is listed on the periodic table. (1 point)
- 3) Pudding is a homogeneous mixture because it contains many different components that are indistinguishable from one another. (1 point)
- 4) Heterogeneous mixtures are generally easier to separate than homogeneous mixtures because the different components are easily identified and frequently easy to pull apart manually. For example, the tuna sandwich in problem 1 is easy to separate (pull the tuna off of the bread). The pudding in problem 3 is far more difficult to separate because everything is so completely mixed. (7 points – Grade based on how complete their answer is)

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Determine whether each of the following are elements, compounds, heterogeneous mixtures, or homogeneous mixtures. (1 point each)

1) tuna sandwich _____

2) silver bracelet _____

3) pudding _____

4) Which is easier to separate, a homogeneous or heterogeneous mixture? Explain your reasoning (7 pts):

Pop Quiz

Determine whether each of the following are elements, compounds, heterogeneous mixtures, or homogeneous mixtures. (1 point each)

1) tuna sandwich _____

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Determine whether each of the following are elements, compounds, heterogeneous mixtures, or homogeneous mixtures. (1 point each)

1) tuna sandwich _____

2) silver bracelet _____

3) pudding _____

4) Which is easier to separate, a homogeneous or heterogeneous mixture? Explain your reasoning (7 pts):

Scientific Notation Pop Quiz

Convert the following numbers into scientific notation. (1 point each)

- 1) 623,000 6.23×10^5
- 2) 230 2.3×10^2
- 3) 0.0034 3.4×10^{-3}
- 4) 12 1.2×10^1
- 5) 0.0000890 8.90×10^{-5}

Convert the following numbers back into standard notation. (1 point each)

- 6) 4.5×10^{-5} 0.000045
- 7) 2.98×10^3 2,980
- 8) 3.1×10^0 3.1
- 9) 6.33×10^{-7} 0.000000633
- 10) 1.1×10^2 110

Suggested Grading Scale

10 = A+
9 = A
8 = B
7 = C
6 = D
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Pop Quiz

Please answer each of the following questions on a separate sheet of paper.

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- 3) 0.0034
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- 10) 1.1×10^2

Significant Figures Pop Quiz

How many significant figures are in each of the following numbers? (1 point each)

- 1) 340 2
- 2) 280,010 5
- 3) 0.0023 2
- 4) 102,000 3
- 5) 102,020 5
- 6) 0.00230 3
- 7) 0.0023020 5
- 8) 1,020.030 7
- 9) 2.3×10^{-3} 2
- 10) 2.3010×10^{-6} 5

Suggested Grading Scale

10 = A+
9 = A
8 = B
7 = C
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< 6 = F

Pop Quiz

How many significant figures are in each of the following numbers? (1 point each)

- 1) 340 _____
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- 3) 0.0023 _____
- 4) 102,000 _____
- 5) 102,020 _____
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- 10) 2.3010×10^{-6} _____

Significant Figures Calculations Pop Quiz

Write the answers to the following problems with the correct number of significant figures. (1 point each)

- 1) $20 + 3.6 = \underline{20}$ (23.6 rounds to 20)
- 2) $9002 - 800 = \underline{8,200}$ (8,202 rounds to 8,200)
- 3) $0.0023 \times 0.0121 = \underline{0.000028}$ (0.0000278 rounds to 0.000028)
- 4) $98 / 0.003 = \underline{30,000}$ (32,667 rounds to 30,000)
- 5) $0.00011 - 78.22 = \underline{-78.22}$ (-78.2199 rounds to -78.22)
- 6) $45 + 6.871 = \underline{52}$ (51.871 rounds to 52)
- 7) $340 \times 0.0005 = \underline{0.2}$ (0.17 rounds to 0.2)
- 8) $65.90 / 34.001 = \underline{1.938}$ (1.93818 rounds to 1.938)
- 9) $4 - 4.6 - 10 = \underline{-10}$ (-10.6 rounds to -10)
- 10) $(3 \times 9.1) + (14.02 / 10) = \underline{30}$ (3 x 9.1 equals 27.3 which rounds to 30. 14.02 / 10 = 1.402 which rounds to 1. When you add 30 + 1, this equals 31, which rounds to 30)

Suggested Grading Scale

- 10 = A+
- 9 = A
- 8 = B
- 7 = C
- 6 = D
- < 6 = F

Pop Quiz

Write the answers to the following problems with the correct number of significant figures. (1 point each)

- 1) $20 + 3.6 =$ _____
- 2) $9002 - 800 =$ _____
- 3) $0.0023 \times 0.0121 =$ _____
- 4) $98 / 0.003 =$ _____
- 5) $0.00011 - 78.22 =$ _____
- 6) $45 + 6.871 =$ _____
- 7) $340 \times 0.0005 =$ _____
- 8) $65.90 / 34.001 =$ _____
- 9) $4 - 4.6 - 10 =$ _____
- 10) $(3 \times 9.1) + (14.02 / 10) =$ _____

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- 9) $4 - 4.6 - 10 =$ _____
- 10) $(3 \times 9.1) + (14.02 / 10) =$ _____

Unit Conversions Pop Quiz

- 1) How many grams are there in 23.4 kilograms? (3 points)
23,400 grams
- 2) How many inches are there in 522 centimeters? *There are 2.54 centimeters in an inch.* (3 points)
206 inches (1325.88 without significant figures)
- 3) How many millimeters are there in 0.0045 decimeters? (5 points)
0.45 millimeters
- 4) How many inches are there in 4.2×10^{-5} miles? *There are 36 inches in a yard and 1760 yards in a mile.* (5 points)
2.7 inches
- 5) Convert 341° C to Kelvins. (3 points)
614 Kelvins
- 6) Convert 881 centuries to days. *There are 1461 days in 4.00 years.* (6 points)
 3.22×10^7 days

Suggested Grading Scale

25 = A+
23 – 24 = A
22 = B+
20 – 21 = B
19 = C+
18 = C
17 = D+
15 – 16 = D
< 15 = F

Pop Quiz

Write the answers to the following problems on a separate sheet of paper.

- 1) How many grams are there in 23.4 kilograms? (3 points)
- 2) How many inches are there in 522 centimeters? *There are 2.54 centimeters in an inch.* (3 points)
- 3) How many millimeters are there in 0.0045 decimeters? (5 points)
- 4) How many inches are there in 4.2×10^{-5} miles? *There are 36 inches in a yard and 1760 yards in a mile.* (5 points)
- 5) Convert 341° C to Kelvins. (3 points)
- 6) Convert 881 centuries to days. *There are 1461 days in 4 years.* (6 points)

Pop Quiz

Write the answers to the following problems on a separate sheet of paper.

- 1) How many grams are there in 23.4 kilograms? (3 points)
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Periodic Table Pop Quiz

What family on the periodic table is most associated with each of the following properties? (1 point each)

- 1) All are diatomic: **Halogens**
- 2) Form +2 ions: **Alkaline earth metals**
- 3) Unreactive: **Noble gases**
- 4) Highest melting and boiling points: **Transition metals**
- 5) Why do elements in the same family have similar properties? (4 points)
Elements in the same family have similar properties because they have the same electron arrangements in their valence shells as other elements in their family.

Suggested Grading Scale

8 = A+

7 = B+

6 = C+

5 = D

< 5 = F

Pop Quiz

What family on the periodic table is most associated with each of the following properties? (1 point each)

- 1) All are diatomic: _____
- 2) Form +2 ions: _____
- 3) Unreactive: _____
- 4) Highest melting and boiling points:

- 5) Why do elements in the same family have similar properties? (4 points)

Pop Quiz

What family on the periodic table is most associated with each of the following properties? (1 point each)

- 1) All are diatomic: _____
- 2) Form +2 ions: _____
- 3) Unreactive: _____
- 4) Highest melting and boiling points:

- 5) Why do elements in the same family have similar properties? (4 points)

Pop Quiz

What family on the periodic table is most associated with each of the following properties? (1 point each)

- 1) All are diatomic: _____
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Pop Quiz

What family on the periodic table is most associated with each of the following properties? (1 point each)

- 1) All are diatomic: _____
- 2) Form +2 ions: _____
- 3) Unreactive: _____
- 4) Highest melting and boiling points:

- 5) Why do elements in the same family have similar properties? (4 points)

Periodic Trends Pop Quiz

Points should be assigned for this problem based on how well the students explain this concept based on what you've gone over in class. If you feel the distinction between electron affinity and electronegativity is an important one, all of the following material should be given. If you feel the distinction is less important, give points based on how well you feel the students have explained what you want them to know.

Briefly explain the difference(s) between electron affinity and electronegativity. (10 points)

Electron affinity is the energy change that occurs when an electron combines with a neutral atom. The more negative the electron affinity (the more exothermic the process is), the more the atom wants to grab electrons. As one might expect, the electron affinity decreases (becomes more negative) as you move across the periodic table and increases (becomes less negative) as you move down the periodic table.

Electronegativity is a measure of how much atoms tend to want to grab electrons from atoms that they're bonded to. Electronegativity is not measured in units of energy as electron affinity is. Rather, it's frequently measured according to a unitless Pauling electronegativity scale. The more electronegative an element is, the more it wants to grab electrons. Electronegativity tends to increase as you move across the periodic table and decrease as you move down the periodic table.

Electron affinity and electronegativity measure basically the same thing – the pull an atom has for electrons. The trends, while seeming to be exactly opposite of one another, both show the same thing. Elements at the far right of the periodic table grab electrons tightly, while elements at the far left don't grab electrons much at all.

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Briefly explain the difference(s) between electron affinity and electronegativity.
(10 points)

Pop Quiz

Briefly explain the difference(s) between electron affinity and electronegativity.
(10 points)

Pop Quiz

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(10 points)

Pop Quiz

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(10 points)

Dalton's Postulates Pop Quiz

Explain Dalton's five postulates of the atom: (10 points – give students two points for each correct postulate)

- **Matter is made of indestructible atoms. Simply put, this means that you can't break an atom.**
- **Atoms of different elements have different properties. Any two elements have different chemical and physical properties from one another.**
- **Atoms of the same element have the same properties. No matter where these atoms come from, the chemical and physical properties of these atoms are identical.**
- **Atoms of different elements combine in simple whole-number ratios to form chemical compounds. Chemical compounds always have the general form A_xB_y , where x and y are whole numbers.**
- **Atoms cannot be created or destroyed in a chemical reaction. This is the same thing as the Law of conservation of mass.**

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Explain Dalton's five postulates of the atom: (10 points)

Pop Quiz

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Pop Quiz

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Pop Quiz

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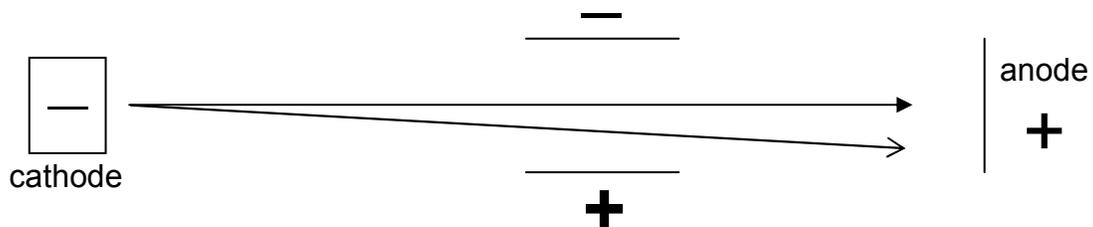
Thomson's Experiment Pop Quiz

Describe the experiment that proved the existence of the electron. (10 points)

Thomson's cathode ray experiment proved the existence of the electron. In this experiment, Thomson set up a cathode ray tube – in it, a beam of “cathode rays” move from the cathode (the negative electrode) toward the anode (the positive electrode).

To determine what the cathode rays were, Thomson did a variety of experiments. In one experiment he placed a small paddlewheel in the cathode ray tube and found that the cathode rays pushed the wheel toward the anode. From this, he determined that cathode rays were made of particles that had mass.

Thomson placed charged plates on the top and bottom of the cathode ray tube and found that the cathode rays tend to deflect toward the positive plate and deflect away from the negative plate. Since like charges repel and opposite charges attract, Thomson determined that the “cathode rays” consisted of particles with negative charge.



Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Describe the experiment that proved the existence of the electron. (10 points)

Pop Quiz

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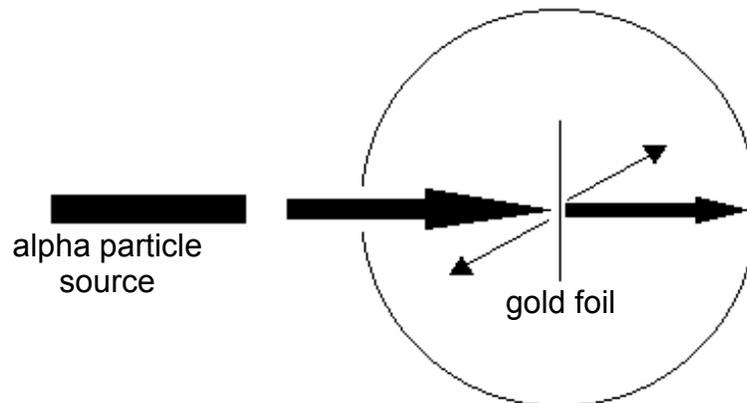
Rutherford's Experiment Pop Quiz

Describe the experiment proving the positive charge in an atom resides in the nucleus. (10 points)

Rutherford's gold foil experiment demonstrated that the positive charge in atoms resides in the nucleus. In this experiment, Rutherford set up an alpha particle emitter such that the particles would hit a very thin piece of gold foil. Alpha particles are the nucleus of the ${}^4\text{He}$ isotope and have a charge of +2.

When the experiment was started, most of the alpha particles passed directly through the gold foil. However, some of the alpha particles were deflected somewhat, with a very few actually bouncing off of the gold foil back toward the alpha emitter. Rutherford was shocked, stating that, "It was almost as if you fired a 15-inch shell into a piece of tissue paper and it came back and hit you."

Rutherford interpreted these results to mean that most of the atom was made of empty space, causing most of the alpha particles to pass directly through the gold foil. He also hypothesized that all of the positive charge in the atom was concentrated in the nucleus, causing positive alpha particles that passed very close to the nucleus to be deflected.



Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Describe the experiment proving the positive charge in an atom resides in the nucleus. (10 points)

Pop Quiz

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Light Emission Pop Quiz

Describe the process by which light is emitted from an atom (8 points)

Give two points for each of the following steps:

- 1) The atom absorbs energy (usually as a photon).
- 2) If the added energy is the same as the difference in energy between the ground state and the excited state of the atom, an electron will be promoted from the ground state into the excited state.
- 3) Eventually the electron falls back down from the excited state into the ground state.
- 4) When the electron falls back into the ground state, the atom gives off exactly the same amount of energy as it absorbed before. This energy is given off as light.

Suggested Grading Scale

8 = A+

7 = B+

6 = C

5 = D

< 5 = F

Pop Quiz

Describe the process by which light is emitted from an atom (8 points)

Pop Quiz

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Pop Quiz

Describe the process by which light is emitted from an atom (8 points)

Quantum Numbers Pop Quiz

Give the quantum numbers for the outermost electron in rubidium (Rb). (8 points)

Give students two points for each of the following:

- $n = 5$ (The outermost electron is in the outermost energy level)
- $l = 0$ (The outermost electron is in an s-orbital)
- $m_l = 0$ (The only allowed value for m_l in an s-orbital is 0)
- $m_s = +1/2$ or $-1/2$ (Either value is fine)

Suggested Grading Scale

8 = A+

7 = B+

6 = C

5 = D

< 5 = F

Pop Quiz

Give the quantum numbers for the outermost electron in rubidium (Rb). (8 points)

Pop Quiz

Give the quantum numbers for the outermost electron in rubidium (Rb). (8 points)

Pop Quiz

Give the quantum numbers for the outermost electron in rubidium (Rb). (8 points)

Pop Quiz

Give the quantum numbers for the outermost electron in rubidium (Rb). (8 points)

Subatomic Particles Pop Quiz

Please fill in the following chart: (1 point per blank)

Isotope	Protons	Neutrons	Electrons
${}^7\text{Li}$	3	4	3
${}^{27}\text{Al}$	13	14	13
${}^{65}\text{Zn}$	30	35	30
${}^{119}\text{Sn}$	50	69	50
${}^{164}\text{Dy}$	66	98	66
${}^{232}\text{Th}$	90	142	90

Suggested Grading Scale

18 = A+

17 = A

16 = B+

15 = B

14 = C+

13 = C

12 = D+

11 = D

< 11 = F

Pop Quiz

Please fill in the following chart: (1 point per blank)

Isotope	Protons	Neutrons	Electrons
${}^7\text{Li}$			
${}^{27}\text{Al}$			
${}^{65}\text{Zn}$			
${}^{119}\text{Sn}$			
${}^{164}\text{Dy}$			
${}^{232}\text{Th}$			

Pop Quiz

Please fill in the following chart: (1 point per blank)

Isotope	Protons	Neutrons	Electrons
${}^7\text{Li}$			
${}^{27}\text{Al}$			
${}^{65}\text{Zn}$			
${}^{119}\text{Sn}$			
${}^{164}\text{Dy}$			
${}^{232}\text{Th}$			

Pop Quiz

Please fill in the following chart: (1 point per blank)

Isotope	Protons	Neutrons	Electrons
${}^7\text{Li}$			
${}^{27}\text{Al}$			
${}^{65}\text{Zn}$			
${}^{119}\text{Sn}$			
${}^{164}\text{Dy}$			
${}^{232}\text{Th}$			

Pop Quiz

Please fill in the following chart: (1 point per blank)

Isotope	Protons	Neutrons	Electrons
${}^7\text{Li}$			
${}^{27}\text{Al}$			
${}^{65}\text{Zn}$			
${}^{119}\text{Sn}$			
${}^{164}\text{Dy}$			
${}^{232}\text{Th}$			

Electron Configurations Pop Quiz

Write the electron configurations for the following elements: (1 point each)

- 1) boron (B) $1s^2 2s^2 2p^1$ or $[\text{He}] 2s^2 2p^1$
- 2) phosphorus (P) $1s^2 2s^2 2p^6 3s^2 3p^3$ or $[\text{Ne}] 3s^2 3p^3$
- 3) zirconium (Zr) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$ or $[\text{Kr}] 5s^2 4d^2$
- 4) iridium (Ir) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^7$ or $[\text{Xe}] 6s^2 4f^{14} 5d^7$
- 5) plutonium (Pu) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^6 7s^2 5f^6$ or $[\text{Rn}] 7s^2 5f^6$

Suggested Grading Scale

5 = A+

4 = B

3 = D

<3 = F

Pop Quiz

Write the electron configurations for the following elements: (1 point each)

- 1) boron (B)
- 2) phosphorus (P)
- 3) zirconium (Zr)
- 4) iridium (Ir)
- 5) plutonium (Pu)

Pop Quiz

Write the electron configurations for the following elements: (1 point each)

- 1) boron (B)
- 2) phosphorus (P)
- 3) zirconium (Zr)
- 4) iridium (Ir)
- 5) plutonium (Pu)

Pop Quiz

Write the electron configurations for the following elements: (1 point each)

- 1) boron (B)
- 2) phosphorus (P)
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Pop Quiz

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- 1) boron (B)
- 2) phosphorus (P)
- 3) zirconium (Zr)
- 4) iridium (Ir)
- 5) plutonium (Pu)

Average Atomic Mass Pop Quiz

A sample of magnesium has the following isotopic abundances:

Isotope	Isotopic mass (amu)	Isotopic abundance (%)
²⁴ Mg	23.99	78.99
²⁵ Mg	24.99	10.00
²⁶ Mg	25.98	11.01

What is the average atomic mass of this sample of magnesium?

Average atomic mass = (abundance of isotope 1)(mass of isotope 1) + (abundance of isotope 2)(mass of isotope 2) + ...

For this problem, the average atomic mass is equal to:

$$(23.99)(0.7899) + (24.99)(0.1000) + (25.98)(0.1101) = 24.31 \text{ amu}$$

Suggested Grading Scale

- If the equation showing how to calculate the average atomic mass is present, give a C.
- If the problem is answered correctly, give an A+.

Pop Quiz

A sample of magnesium has the following isotopic abundances:

Isotope	Isotopic mass (amu)	Isotopic abundance (%)
^{24}Mg	23.99	78.99
^{25}Mg	24.99	10.00
^{26}Mg	25.98	11.01

What is the average atomic mass of this sample of magnesium?

Pop Quiz

A sample of magnesium has the following isotopic abundances:

Isotope	Isotopic mass (amu)	Isotopic abundance (%)
^{24}Mg	23.99	78.99
^{25}Mg	24.99	10.00
^{26}Mg	25.98	11.01

What is the average atomic mass of this sample of magnesium?

Pop Quiz

A sample of magnesium has the following isotopic abundances:

Isotope	Isotopic mass (amu)	Isotopic abundance (%)
^{24}Mg	23.99	78.99
^{25}Mg	24.99	10.00
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Pop Quiz

A sample of magnesium has the following isotopic abundances:

Isotope	Isotopic mass (amu)	Isotopic abundance (%)
^{24}Mg	23.99	78.99
^{25}Mg	24.99	10.00
^{26}Mg	25.98	11.01

What is the average atomic mass of this sample of magnesium?

Octet Rule Pop Quiz

Explain the relationship between the octet rule and the formation of ionic compounds from neutral atoms. (10 points)

Give students 2.5 points for each of the following. Give partial credit as necessary:

- A statement of the octet rule: “All elements want to be like the nearest noble gas” OR “All elements want to have eight electrons in their outermost energy level” OR “All elements tend to react such that they end up with a completely filled outer energy level.” The precise wording of the octet rule is not important. What is important is that the student articulates the meaning of the octet rule.
- When two elements have a very large difference in electronegativity, the less electronegative element transfers electrons to the more electronegative element so that both end up with a completely filled octet.
- The more electronegative element becomes the anion and the less electronegative element becomes the cation.
- Because opposite charges attract, an ionic compound is formed.

Suggested Grading Scale

10 = A+

9 – 9.5 = A

8.5 = B+

8 = B

7.5 = C+

7 = C

6.5 = D+

6 = D

< 6 = F

Pop Quiz

Explain the relationship between the octet rule and the formation of ionic compounds from neutral atoms. (10 points)

Pop Quiz

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Pop Quiz

Explain the relationship between the octet rule and the formation of ionic compounds from neutral atoms. (10 points)

Ionic Properties Pop Quiz

Explain why ionic compounds have the following properties: (10 points)

- hard and brittle
- high melting and boiling points

Give five points for each of these answers (assign partial credit based on how correct the answers are):

Ionic compounds are hard and brittle because the cations and anions are held so tightly to one another. Additionally, the cations and anions are located in a regular pattern, causing natural shear planes where the crystal can break. If you exert enough force on an ionic compound to move the ions, chances are that you've put so much energy into the lattice that it will shatter along these natural planes.

Ionic compounds have high melting and boiling points because of the strong attraction between the cations and anions. When you melt or boil a substance, this causes the particles to move freely with respect to one another. In ionic compounds it requires a very large amount of heat to cause this free movement because the cations and anions are so strongly attracted.

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Explain why ionic compounds have the following properties: (10 points)

- hard and brittle
- high melting and boiling points

Pop Quiz

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Pop Quiz

Explain why ionic compounds have the following properties: (10 points)

- hard and brittle
- high melting and boiling points

Naming Ionic Compounds Pop Quiz

Name the following ionic compounds (1 point each):

- 1) AgBr **silver bromide**
- 2) FeSO₄ **iron (II) sulfate**
- 3) Mg(OH)₂ **magnesium hydroxide**
- 4) TiCl₄ **titanium (IV) chloride**
- 5) NH₄NO₃ **ammonium nitrate**

Write the formulas of the following ionic compounds (1 point each):

- 6) lithium acetate **LiC₂H₃O₂ OR LiCH₃COO**
- 7) zinc sulfide **ZnS**
- 8) chromium (VI) oxide **CrO₃**
- 9) nickel (III) phosphate **NiPO₄**
- 10) potassium nitrate **KNO₃**

Suggested Grading Scale

10 = A+
9 = A
8 = B
7 = C
6 = D
< 6 = F

Pop Quiz

Name the following ionic compounds (1 point each):

- 1) AgBr _____
- 2) FeSO₄ _____
- 3) Mg(OH)₂ _____
- 4) TiCl₄ _____
- 5) NH₄NO₃ _____

Write the formulas of the following ionic compounds (1 point each):

- 6) lithium acetate _____
- 7) zinc sulfide _____
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Write the formulas of the following ionic compounds (1 point each):

- 6) lithium acetate _____
- 7) zinc sulfide _____
- 8) chromium (VI) oxide _____
- 9) nickel (III) phosphate _____
- 10) potassium nitrate _____

Mole Calculations Pop Quiz

- 1) How many grams are there in 3.9 moles of copper (II) sulfate? (3 pts)
620 grams (622.4 grams without significant figures)
- 2) How many moles are there in 9.43×10^{22} atoms of zinc? (3 pts)
0.157 moles
- 3) How many grams are there in 2.8×10^{24} molecules of lithium oxide? (5 pts)
140 grams (138.6 grams without significant figures)
- 4) How many molecules are there in 2.9 grams of lead (IV) acetate? (5 points)
 3.9×10^{21} molecules

Suggested Grading Scale

16 = A+
15 = A
14 = B+
13 = B
12 = C+
11 = D+
10 = D
< 10 = F

Pop Quiz

Answer the following questions on a separate sheet of paper.

- 1) How many grams are there in 3.9 moles of copper (II) sulfate? (3 pts)
- 2) How many moles are there in 9.43×10^{22} atoms of zinc? (3 pts)
- 3) How many grams are there in 2.8×10^{24} molecules of lithium oxide? (5 pts)
- 4) How many molecules are there in 2.9 grams of lead (IV) acetate? (5 points)

Pop Quiz

Answer the following questions on a separate sheet of paper.

- 1) How many grams are there in 3.9 moles of copper (II) sulfate? (3 pts)
- 2) How many moles are there in 9.43×10^{22} atoms of zinc? (3 pts)
- 3) How many grams are there in 2.8×10^{24} molecules of lithium oxide? (5 pts)
- 4) How many molecules are there in 2.9 grams of lead (IV) acetate? (5 points)

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- 1) How many grams are there in 3.9 moles of copper (II) sulfate? (3 pts)
- 2) How many moles are there in 9.43×10^{22} atoms of zinc? (3 pts)
- 3) How many grams are there in 2.8×10^{24} molecules of lithium oxide? (5 pts)
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- 1) How many grams are there in 3.9 moles of copper (II) sulfate? (3 pts)
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- 4) How many molecules are there in 2.9 grams of lead (IV) acetate? (5 points)

Percent Composition Pop Quiz

3-hexene has a percent composition of 85.7% carbon and 14.3% hydrogen and a molar mass of 84.0 grams/mole. Using this information, find the empirical and molecular formulas of this compound.

To find the empirical formula, students should convert the percent values to grams and find the number of moles of each compound. In the case of carbon, 85.7 grams of carbon converts to 7.14 moles – for hydrogen, 14.3 grams is equivalent to 14.3 moles. The next step is to divide both of these mole values by the smallest one, yielding an empirical formula of C_1H_2 .

To find the molecular formula, find the mass of the empirical formula, in this case, 14.0 grams. Next, divide the actual molar mass by the empirical mass ($84.0 \text{ grams} / 14.0 \text{ grams} = 6.00$). If you multiply the subscripts on the empirical formula by six, this yields a molecular formula of C_6H_{12} , which is the correct formula for 3-hexene.

Suggested Grading Scale

- For correctly completing only the empirical formula, give a C.
- For correctly completing the entire problem, give an A+.
- Partial credit should be given where appropriate.

Pop Quiz

3-hexene has a percent composition of 85.7% carbon and 14.3% hydrogen and a molar mass of 84.0 grams/mole. Using this information, find the empirical and molecular formulas of this compound.

Pop Quiz

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3-hexene has a percent composition of 85.7% carbon and 14.3% hydrogen and a molar mass of 84.0 grams/mole. Using this information, find the empirical and molecular formulas of this compound.

Octet Rule (Covalent Compounds) Pop Quiz

Explain the relationship between the octet rule and the formation of covalent compounds from neutral atoms. (9 points)

Give students three points for each of the following. Give partial credit as necessary:

- A statement of the octet rule: “All elements want to be like the nearest noble gas” OR “All elements want to have eight electrons in their outermost energy level” OR “All elements tend to react such that they end up with a completely filled outer energy level.” The precise wording of the octet rule is not important. What is important is that the student articulates the meaning of the octet rule.
- When two elements have a small difference in electronegativity, neither element is able to take electrons from the other. As a result, the atoms have to share electrons.
- When elements share electrons, this is called a covalent bond.
- Two bonus points if students mention anything about polar covalent bonds.

Suggested Grading Scale

9 or greater = A+

8 = B+

7 = C+

6 = D+

< 6 = F

Pop Quiz

Explain the relationship between the octet rule and the formation of covalent compounds from neutral atoms. (9 points)

Pop Quiz

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Pop Quiz

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Hydrogen Bonding Pop Quiz

Explain what hydrogen bonding is and give two examples of molecules in which hydrogen bonding is the main intermolecular force. (12 points)

- **Hydrogen bonding occurs when a hydrogen atom bonded to an electronegative atom (such as sulfur, nitrogen, or oxygen) is attracted to the lone pair electrons on an electronegative atom on a different molecule. (6 points)**
- **Hydrogen bonding is by far the strongest intermolecular force, affecting molecular properties more than dipole-dipole forces or London dispersion forces. (4 points)**
- **Any two molecules that undergo hydrogen bonding may be listed here for one point each. Common examples of molecules that undergo hydrogen bonding are hydrogen sulfide (H₂S), water, ammonia, hydrogen halides (HX, where X is a halogen), organic bases, organic acids, ethers, esters, alcohols, sugars, etc. (1 point each)**

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

Explain what hydrogen bonding is and give two examples of molecules in which hydrogen bonding is the main intermolecular force. (12 points)

Pop Quiz

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Pop Quiz

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Pop Quiz

Explain what hydrogen bonding is and give two examples of molecules in which hydrogen bonding is the main intermolecular force. (12 points)

Intermolecular Forces Pop Quiz

- 1) What are the main differences between an intermolecular force and a chemical bond? (5 points)

Give 2.5 points for each of the following:

- **Intermolecular forces consist of forces between different molecules and chemical bonds are forces between atoms in the same molecule.**
- **Intermolecular forces are far weaker than chemical bonds.**

- 2) List the three main intermolecular forces. (1 point each)

- **Hydrogen bonds**
- **dipole-dipole forces**
- **London dispersion forces**

Suggested Grading Scale

8 = A+

7 = B+

6 = C+

5 = D

< 5 = F

Pop Quiz

1) What are the main differences between an intermolecular force and a chemical bond? (5 points)

2) List the three main intermolecular forces. (1 point each)

-
-
-

Pop Quiz

1) What are the main differences between an intermolecular force and a chemical bond? (5 points)

2) List the three main intermolecular forces. (1 point each)

-
-
-

Pop Quiz

1) What are the main differences between an intermolecular force and a chemical bond? (5 points)

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-
-
-

Pop Quiz

1) What are the main differences between an intermolecular force and a chemical bond? (5 points)

2) List the three main intermolecular forces. (1 point each)

-
-
-

Covalent Compound Naming Pop Quiz

For problems 1-5, name the covalent compound: (1 point each)

- 1) NH_3 **ammonia**
- 2) AsF_5 **arsenic pentafluoride**
- 3) BrO_2 **bromine dioxide**
- 4) C_2Cl_4 **dicarbon tetrachloride**
- 5) HI **hydrogen iodide**

For problems 6-10, give the formula of the covalent compound: (1 point each)

- 6) dinitrogen trioxide **N_2O_3**
- 7) phosphorus trichloride **PCl_3**
- 8) diselenium dibromide **Se_2Br_2**
- 9) disilicon hexabromide **Si_2Br_6**
- 10) fluorine **F_2**

Suggested Grading Scale

10 = A+
9 = A
8 = B
7 = C
6 = D
< 6 = F

Pop Quiz

For problems 1-5, name the covalent compound: (1 point each)

- 1) NH_3 _____
- 2) AsF_5 _____
- 3) BrO_2 _____
- 4) C_2Cl_4 _____
- 5) HI _____

For problems 6-10, give the formula of the covalent compound: (1 point each)

- 6) dinitrogen trioxide _____
- 7) phosphorus trichloride _____
- 8) diselenium dibromide _____
- 9) disilicon hexabromide _____
- 10) fluorine _____

Pop Quiz

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- 5) HI _____

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- 5) HI _____

For problems 6-10, give the formula of the covalent compound: (1 point each)

- 6) dinitrogen trioxide _____
- 7) phosphorus trichloride _____
- 8) diselenium dibromide _____
- 9) disilicon hexabromide _____
- 10) fluorine _____

Pop Quiz

For problems 1-5, name the covalent compound: (1 point each)

- 1) NH_3 _____
- 2) AsF_5 _____
- 3) BrO_2 _____
- 4) C_2Cl_4 _____
- 5) HI _____

For problems 6-10, give the formula of the covalent compound: (1 point each)

- 6) dinitrogen trioxide _____
- 7) phosphorus trichloride _____
- 8) diselenium dibromide _____
- 9) disilicon hexabromide _____
- 10) fluorine _____

Mixed Compound Naming Pop Quiz

For problems 1-5, name each compound: (1 point each)

- 1) CH_4 **methane**
- 2) Na_2SO_4 **sodium sulfate**
- 3) CO **carbon monoxide**
- 4) BrF_3 **bromine trifluoride**
- 5) $\text{Fe}(\text{NO}_3)_3$ **iron (III) nitrate**

For problems 6-10, give the formula of each compound: (1 point each)

- 6) titanium (IV) oxide **TiO_2**
- 7) hydrogen iodide **HI**
- 8) copper (I) hydroxide **CuOH**
- 9) potassium sulfide **K_2S**
- 10) tetrasulfur tetranitride **S_4N_4**

Suggested Grading Scale

- 10 = A+**
- 9 = A**
- 8 = B**
- 7 = C**
- 6 = D**
- < 6 = F**

Pop Quiz

For problems 1-5, name each compound: (1 point each)

- 1) CH_4 _____
- 2) Na_2SO_4 _____
- 3) CO _____
- 4) BrF_3 _____
- 5) $\text{Fe}(\text{NO}_3)_3$ _____

For problems 6-10, give the formula of each compound: (1 point each)

- 6) titanium (IV) oxide _____
- 7) hydrogen iodide _____
- 8) copper (I) hydroxide _____
- 9) potassium sulfide _____
- 10) tetrasulfur tetranitride _____

Pop Quiz

For problems 1-5, name each compound: (1 point each)

- 1) CH_4 _____
- 2) Na_2SO_4 _____
- 3) CO _____
- 4) BrF_3 _____
- 5) $\text{Fe}(\text{NO}_3)_3$ _____

For problems 6-10, give the formula of each compound: (1 point each)

- 6) titanium (IV) oxide _____
- 7) hydrogen iodide _____
- 8) copper (I) hydroxide _____
- 9) potassium sulfide _____
- 10) tetrasulfur tetranitride _____

Pop Quiz

For problems 1-5, name each compound: (1 point each)

- 1) CH_4 _____
- 2) Na_2SO_4 _____
- 3) CO _____
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For problems 6-10, give the formula of each compound: (1 point each)

- 6) titanium (IV) oxide _____
- 7) hydrogen iodide _____
- 8) copper (I) hydroxide _____
- 9) potassium sulfide _____
- 10) tetrasulfur tetranitride _____

Pop Quiz

For problems 1-5, name each compound: (1 point each)

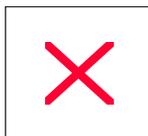
- 1) CH_4 _____
- 2) Na_2SO_4 _____
- 3) CO _____
- 4) BrF_3 _____
- 5) $\text{Fe}(\text{NO}_3)_3$ _____

For problems 6-10, give the formula of each compound: (1 point each)

- 6) titanium (IV) oxide _____
- 7) hydrogen iodide _____
- 8) copper (I) hydroxide _____
- 9) potassium sulfide _____
- 10) tetrasulfur tetranitride _____

Lewis Structures Pop Quiz

- 1) Draw the Lewis structure of phosphorus trifluoride. (3 points)
Give the students one point for having the formula correct, one point for having the atoms bonded to each other in the correct positions with the correct number of bonds, and one point for having the correct number of valence electrons on each atom.



- 2) What shape is phosphorus trifluoride? (1 point)
trigonal pyramidal

- 3) Draw the Lewis structure of silicon disulfide. (3 points)
Give the students one point for having the formula correct, one point for having the atoms bonded to each other in the correct positions with the correct number of bonds, and one point for having the correct number of valence electrons on each atom.



- 4) What shape is silicon disulfide? (1 point)
linear

Suggested Grading Scale

8 = A+

7 = B+

6 = C+

5 = D

< 5 = F

Pop Quiz

- 1) Draw the Lewis structure of phosphorus trifluoride. (3 points)
- 2) What shape is phosphorus trifluoride? (1 point)
- 3) Draw the Lewis structure of silicon disulfide. (3 points)
- 4) What shape is silicon disulfide? (1 point)

Pop Quiz

- 1) Draw the Lewis structure of phosphorus trifluoride. (3 points)
- 2) What shape is phosphorus trifluoride? (1 point)
- 3) Draw the Lewis structure of silicon disulfide. (3 points)
- 4) What shape is silicon disulfide? (1 point)

Pop Quiz

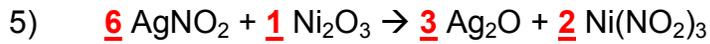
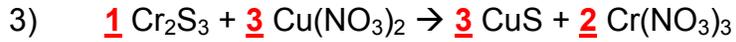
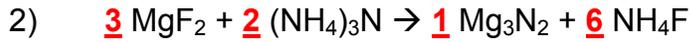
- 1) Draw the Lewis structure of phosphorus trifluoride. (3 points)
- 2) What shape is phosphorus trifluoride? (1 point)
- 3) Draw the Lewis structure of silicon disulfide. (3 points)
- 4) What shape is silicon disulfide? (1 point)

Pop Quiz

- 1) Draw the Lewis structure of phosphorus trifluoride. (3 points)
- 2) What shape is phosphorus trifluoride? (1 point)
- 3) Draw the Lewis structure of silicon disulfide. (3 points)
- 4) What shape is silicon disulfide? (1 point)

Balancing Equations Pop Quiz

Balance the following equations: (1 point each)



Suggested Grading Scale

5 = A+

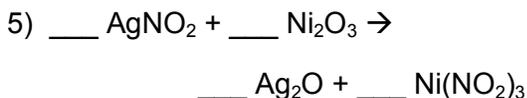
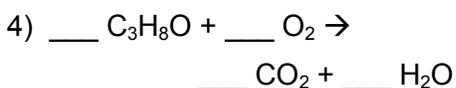
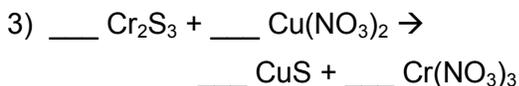
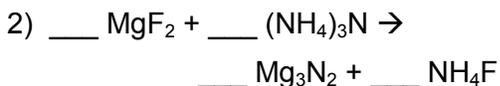
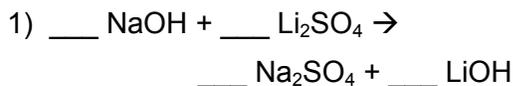
4 = B

3 = D

< 3 = F

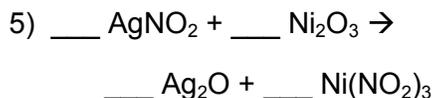
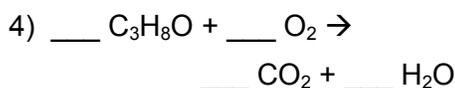
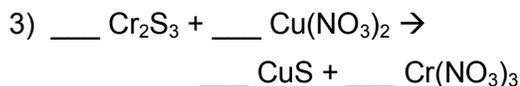
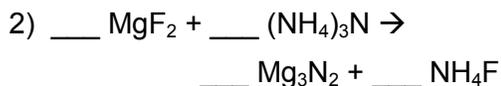
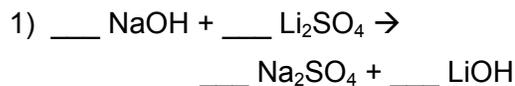
Pop Quiz

Balance the following equations: (1 point each)



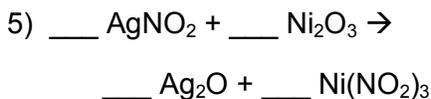
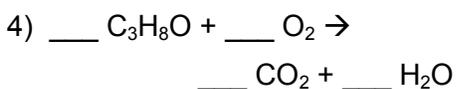
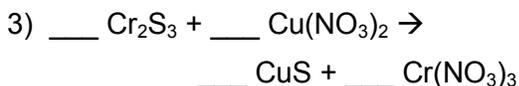
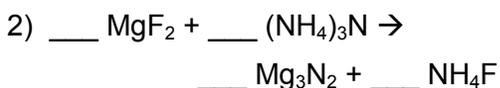
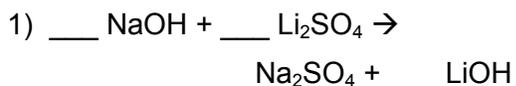
Pop Quiz

Balance the following equations: (1 point each)



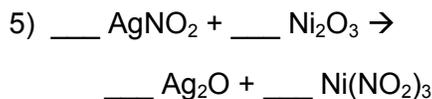
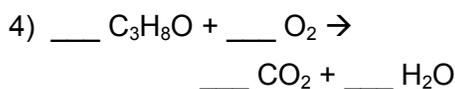
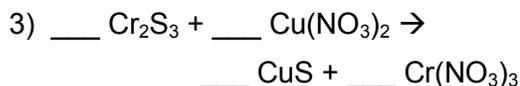
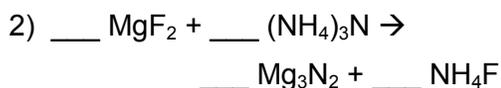
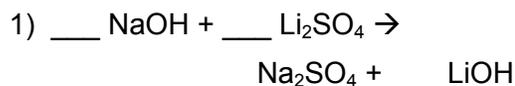
Pop Quiz

Balance the following equations: (1 point each)



Pop Quiz

Balance the following equations: (1 point each)



Writing Complete Equations Pop Quiz

Write complete, balanced equations for each of the following statements on a separate sheet of paper: (3 points each)

For these questions, give one point for each of the following:

- **The correct formulas for all reagents and products**
- **Correctly balancing the equation**
- **Having the correct symbols in the equation (aq, g, Δ, etc.)**

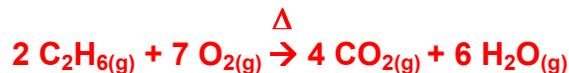
- 1) When solid sodium azide (NaN_3) decomposes in a car airbag, it gives off sodium nitride powder and nitrogen gas.



- 2) When oxygen gas reacts with iron metal, it forms iron (III) oxide (also known as rust).



- 3) When gaseous ethane (C_2H_6) burns in oxygen, it forms carbon dioxide gas and water vapor.



- 4) When an aqueous solution of nitric acid reacts with potassium hydroxide pellets, liquid water and an aqueous solution of potassium nitrate are formed.



Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

Write complete, balanced equations for each of the following statements on a separate sheet of paper: (3 points each)

- 1) When solid sodium azide (NaN_3) decomposes in a car airbag, it gives off sodium nitride powder and nitrogen gas.
- 2) When oxygen gas reacts with iron metal, it forms iron (III) oxide (also known as rust).
- 3) When gaseous ethane (C_2H_6) burns in oxygen, it forms carbon dioxide gas and water vapor.
- 4) When an aqueous solution of nitric acid reacts with potassium hydroxide pellets, liquid water and an aqueous solution of potassium nitrate are formed.

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- 4) When an aqueous solution of nitric acid reacts with potassium hydroxide pellets, liquid water and an aqueous solution of potassium nitrate are formed.

Types of Reactions Pop Quiz

On a separate sheet of paper, indicate what type of reaction is taking place for each of the following: (1 point each)

- 1) $2 \text{NaBr} + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaBr}_2$ **Double displacement**
- 2) $3 \text{Pb} + 4 \text{Fe(NO}_3)_3 \rightarrow 3 \text{Pb(NO}_3)_4 + 4 \text{Fe}$ **Single displacement**
- 3) $\text{S}_8 + 24 \text{F}_2 \rightarrow 8 \text{SF}_6$ **Synthesis**
- 4) $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O}$ **Combustion**
- 5) $2 \text{HNO}_3 + \text{Mg(OH)}_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg(NO}_3)_2$ **Acid-base**
- 6) $\text{B}_2\text{H}_6 \rightarrow 2 \text{BH}_3$ **Decomposition**
- 7) $\text{C}_2\text{H}_2 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_2\text{Cl}_2$ **Synthesis**
- 8) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ **Synthesis**
- 9) $\text{Al}_2(\text{SO}_4)_3 + 6 \text{LiBr} \rightarrow 2 \text{AlBr}_3 + 3 \text{Li}_2\text{SO}_4$ **Double displacement**
- 10) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 12 \text{CO}_2 + 6 \text{H}_2\text{O}$ **Combustion**

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

On a separate sheet of paper, indicate what type of reaction is taking place for each of the following: (1 point each)

- 1) $2 \text{NaBr} + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaBr}_2$
- 2) $3 \text{Pb} + 4 \text{Fe(NO}_3)_3 \rightarrow 3 \text{Pb(NO}_3)_4 + 4 \text{Fe}$
- 3) $\text{S}_8 + 24 \text{F}_2 \rightarrow 8 \text{SF}_6$
- 4) $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O}$
- 5) $2 \text{HNO}_3 + \text{Mg(OH)}_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg(NO}_3)_2$
- 6) $\text{B}_2\text{H}_6 \rightarrow 2 \text{BH}_3$
- 7) $\text{C}_2\text{H}_2 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_2\text{Cl}_2$
- 8) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$
- 9) $\text{Al}_2(\text{SO}_4)_3 + 6 \text{LiBr} \rightarrow 2 \text{AlBr}_3 + 3 \text{Li}_2\text{SO}_4$
- 10) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 12 \text{CO}_2 + 6 \text{H}_2\text{O}$

Pop Quiz

On a separate sheet of paper, indicate what type of reaction is taking place for each of the following: (1 point each)

- 1) $2 \text{NaBr} + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaBr}_2$
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- 5) $2 \text{HNO}_3 + \text{Mg(OH)}_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg(NO}_3)_2$
- 6) $\text{B}_2\text{H}_6 \rightarrow 2 \text{BH}_3$
- 7) $\text{C}_2\text{H}_2 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_2\text{Cl}_2$
- 8) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$
- 9) $\text{Al}_2(\text{SO}_4)_3 + 6 \text{LiBr} \rightarrow 2 \text{AlBr}_3 + 3 \text{Li}_2\text{SO}_4$
- 10) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 12 \text{CO}_2 + 6 \text{H}_2\text{O}$

Pop Quiz

On a separate sheet of paper, indicate what type of reaction is taking place for each of the following: (1 point each)

- 1) $2 \text{NaBr} + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaBr}_2$
- 2) $3 \text{Pb} + 4 \text{Fe(NO}_3)_3 \rightarrow 3 \text{Pb(NO}_3)_4 + 4 \text{Fe}$
- 3) $\text{S}_8 + 24 \text{F}_2 \rightarrow 8 \text{SF}_6$
- 4) $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2 + 10 \text{H}_2\text{O}$
- 5) $2 \text{HNO}_3 + \text{Mg(OH)}_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg(NO}_3)_2$
- 6) $\text{B}_2\text{H}_6 \rightarrow 2 \text{BH}_3$
- 7) $\text{C}_2\text{H}_2 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_2\text{Cl}_2$
- 8) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$
- 9) $\text{Al}_2(\text{SO}_4)_3 + 6 \text{LiBr} \rightarrow 2 \text{AlBr}_3 + 3 \text{Li}_2\text{SO}_4$
- 10) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 12 \text{CO}_2 + 6 \text{H}_2\text{O}$

Pop Quiz

On a separate sheet of paper, indicate what type of reaction is taking place for each of the following: (1 point each)

- 1) $2 \text{NaBr} + \text{Ca(OH)}_2 \rightarrow 2 \text{NaOH} + \text{CaBr}_2$
- 2) $3 \text{Pb} + 4 \text{Fe(NO}_3)_3 \rightarrow 3 \text{Pb(NO}_3)_4 + 4 \text{Fe}$
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- 5) $2 \text{HNO}_3 + \text{Mg(OH)}_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg(NO}_3)_2$
- 6) $\text{B}_2\text{H}_6 \rightarrow 2 \text{BH}_3$
- 7) $\text{C}_2\text{H}_2 + \text{Cl}_2 \rightarrow \text{C}_2\text{H}_2\text{Cl}_2$
- 8) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$
- 9) $\text{Al}_2(\text{SO}_4)_3 + 6 \text{LiBr} \rightarrow 2 \text{AlBr}_3 + 3 \text{Li}_2\text{SO}_4$
- 10) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 12 \text{CO}_2 + 6 \text{H}_2\text{O}$

Predicting Reaction Products Pop Quiz

On a separate sheet of paper, write the products for the following equations and indicate what type of reaction is taking place. Make sure your final equations are balanced! (3 points each)

For each question, give one point for predicting the correct reaction products, one point for balancing the equation correctly, and one point for correctly determining the type of chemical reaction taking place.

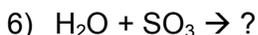
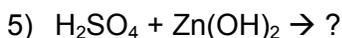
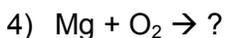
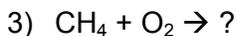
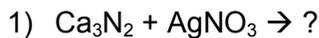
- 1) $\underline{1} \text{ Ca}_3\text{N}_2 + \underline{6} \text{ AgNO}_3 \rightarrow \underline{3} \text{ Ca}(\text{NO}_3)_2 + \underline{2} \text{ Ag}_3\text{N}$ **Double displacement**
- 2) $\underline{1} \text{ HBr} + \underline{1} \text{ LiOH} \rightarrow \underline{1} \text{ H}_2\text{O} + \underline{1} \text{ LiBr}$ **Acid-base**
- 3) $\underline{1} \text{ CH}_4 + \underline{2} \text{ O}_2 \rightarrow \underline{1} \text{ CO}_2 + \underline{2} \text{ H}_2\text{O}$ **Combustion**
- 4) $\underline{2} \text{ Mg} + \underline{1} \text{ O}_2 \rightarrow \underline{2} \text{ MgO}$ **Synthesis**
- 5) $\underline{1} \text{ H}_2\text{SO}_4 + \underline{1} \text{ Zn}(\text{OH})_2 \rightarrow \underline{1} \text{ ZnSO}_4 + \underline{2} \text{ H}_2\text{O}$ **Acid-base**
- 6) $\underline{1} \text{ H}_2\text{O} + \underline{1} \text{ SO}_3 \rightarrow \underline{1} \text{ H}_2\text{SO}_4$ **Synthesis**
- 7) $\underline{6} \text{ Li} + \underline{1} \text{ Fe}_2\text{O}_3 \rightarrow \underline{3} \text{ Li}_2\text{O} + \underline{2} \text{ Fe}$ **Single displacement**
- 8) $\underline{3} \text{ O}_2 + \underline{1} \text{ C}_2\text{H}_4 \rightarrow \underline{2} \text{ CO}_2 + \underline{2} \text{ H}_2\text{O}$ **Combustion**

Suggested Grading Scale

24 = A+
22 – 23 = A
21 = B+
20 = B
18 – 19 = C+
17 = C
16 = D+
15 = D
< 15 = F

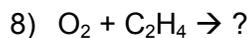
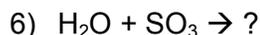
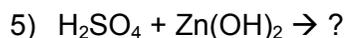
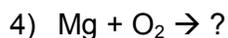
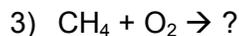
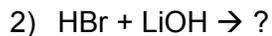
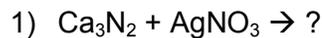
Pop Quiz

On a separate sheet of paper, write the products for the following equations and indicate what type of reaction is taking place. Make sure your final equations are balanced! (3 points each)



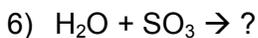
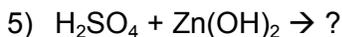
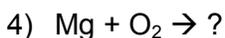
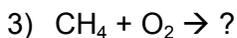
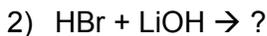
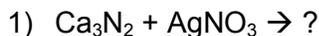
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On a separate sheet of paper, write the products for the following equations and indicate what type of reaction is taking place. Make sure your final equations are balanced! (3 points each)



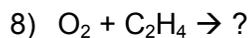
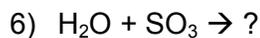
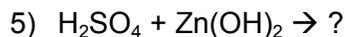
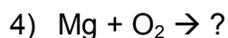
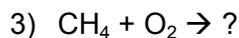
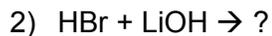
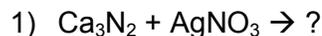
Pop Quiz

On a separate sheet of paper, write the products for the following equations and indicate what type of reaction is taking place. Make sure your final equations are balanced! (3 points each)



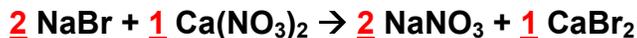
Pop Quiz

On a separate sheet of paper, write the products for the following equations and indicate what type of reaction is taking place. Make sure your final equations are balanced! (3 points each)



Grams to Grams Stoichiometry Pop Quiz

On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point) **See equation above.**
- 2) How many grams of sodium nitrate can be formed from 25 grams of calcium nitrate? (3 points)
26 grams
- 3) If 11 grams of sodium nitrate were actually formed, what is the percent yield of this reaction? (3 points)
42 %
- 4) How many grams of sodium bromide would be needed to make 15 grams of sodium nitrate? (3 points)
18 grams

Suggested Grading Scale

10 = A+

9 = A

8 = B

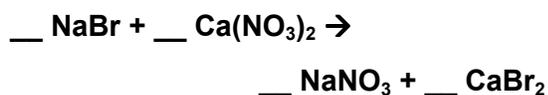
7 = C

6 = D

< 6 = F

Pop Quiz

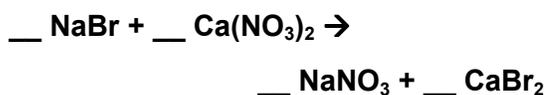
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) How many grams of sodium nitrate can be formed from 25 grams of calcium nitrate? (3 points)
- 3) If 11 grams of sodium nitrate were actually formed, what is the percent yield of this reaction? (3 points)
- 4) How many grams of sodium bromide would be needed to make 15 grams of sodium nitrate? (3 points)

Pop Quiz

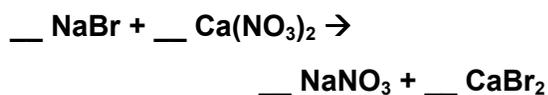
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) How many grams of sodium nitrate can be formed from 25 grams of calcium nitrate? (3 points)
- 3) If 11 grams of sodium nitrate were actually formed, what is the percent yield of this reaction? (3 points)
- 4) How many grams of sodium bromide would be needed to make 15 grams of sodium nitrate? (3 points)

Pop Quiz

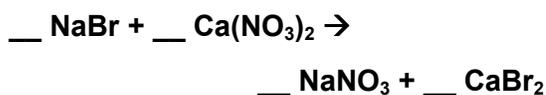
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) How many grams of sodium nitrate can be formed from 25 grams of calcium nitrate? (3 points)
- 3) If 11 grams of sodium nitrate were actually formed, what is the percent yield of this reaction? (3 points)
- 4) How many grams of sodium bromide would be needed to make 15 grams of sodium nitrate? (3 points)

Pop Quiz

On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) How many grams of sodium nitrate can be formed from 25 grams of calcium nitrate? (3 points)
- 3) If 11 grams of sodium nitrate were actually formed, what is the percent yield of this reaction? (3 points)
- 4) How many grams of sodium bromide would be needed to make 15 grams of sodium nitrate? (3 points)

Stoichiometry Terms Pop Quiz

- 1) What is a “mole ratio”? (3 points)
A mole ratio is used in stoichiometry when making a gram-to-gram or mole-to-mole conversion. The mole ratio is equivalent to the coefficient in front of the compound you’re solving for divided by the coefficient in front of the compound you’ve been given in the problem.
- 2) What is the equation for “percent yield”? (3 points)
Percent yield = [(actual yield) / (theoretical yield)] x 100%
- 3) What is a “limiting reagent”? (3 points)
The limiting reagent is the reagent that limits the amount of product that can be formed in a chemical reaction. For example, if you were trying to make water from 10 grams of hydrogen gas and 1.0×10^{10} grams of oxygen gas, hydrogen would be your limiting reagent.

Suggested Grading Scale

9 = A+
8 = B+
7 = C+
6 = D+
< 6 = F

Pop Quiz

- 1) What is a "mole ratio"? (3 points)
- 2) What is the equation for "percent yield"? (3 points)
- 3) What is a "limiting reagent"? (3 points)

Pop Quiz

- 1) What is a "mole ratio"? (3 points)
- 2) What is the equation for "percent yield"? (3 points)
- 3) What is a "limiting reagent"? (3 points)

Pop Quiz

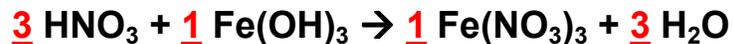
- 1) What is a "mole ratio"? (3 points)
- 2) What is the equation for "percent yield"? (3 points)
- 3) What is a "limiting reagent"? (3 points)

Pop Quiz

- 1) What is a "mole ratio"? (3 points)
- 2) What is the equation for "percent yield"? (3 points)
- 3) What is a "limiting reagent"? (3 points)

Limiting Reagent Pop Quiz

On a separate sheet of paper, answer the following questions using the equation below:



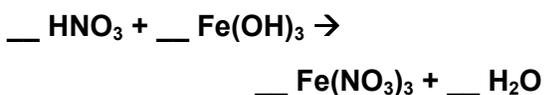
- 1) Balance the equation above. (1 point) **See equation above.**
- 2) If I start with 25 grams of nitric acid and 55 grams of iron (III) hydroxide, how many grams of iron (III) nitrate can be formed? (3 points)
32 grams
- 3) What is my limiting reagent in problem #2? (2 points)
nitric acid
- 4) How many grams of iron (III) nitrate could I make if I added a large excess of my limiting reagent? (3 points)
This question is essentially asking you how much iron (III) nitrate you could make if iron (III) hydroxide were your limiting reagent. From question #2, this should have been calculated to be 120 grams (124.5 without using significant figures).

Suggested Grading Scale

9 = A+
8 = B+
7 = C+
6 = D+
< 6 = F

Pop Quiz

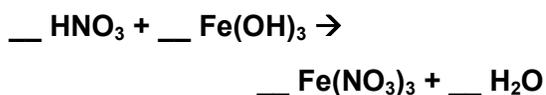
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) If I start with 25 grams of nitric acid and 55 grams of iron (III) hydroxide, how many grams of iron (III) nitrate can be formed? (3 points)
- 3) What is my limiting reagent in problem #2? (2 points)
- 4) How many grams of iron (III) nitrate could I make if I added a large excess of my limiting reagent? (3 points)

Pop Quiz

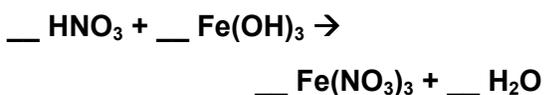
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) If I start with 25 grams of nitric acid and 55 grams of iron (III) hydroxide, how many grams of iron (III) nitrate can be formed? (3 points)
- 3) What is my limiting reagent in problem #2? (2 points)
- 4) How many grams of iron (III) nitrate could I make if I added a large excess of my limiting reagent? (3 points)

Pop Quiz

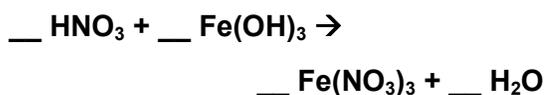
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) If I start with 25 grams of nitric acid and 55 grams of iron (III) hydroxide, how many grams of iron (III) nitrate can be formed? (3 points)
- 3) What is my limiting reagent in problem #2? (2 points)
- 4) How many grams of iron (III) nitrate could I make if I added a large excess of my limiting reagent? (3 points)

Pop Quiz

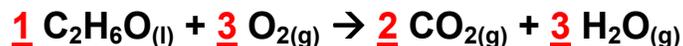
On a separate sheet of paper, answer the following questions using the equation below:



- 1) Balance the equation above. (1 point)
- 2) If I start with 25 grams of nitric acid and 55 grams of iron (III) hydroxide, how many grams of iron (III) nitrate can be formed? (3 points)
- 3) What is my limiting reagent in problem #2? (2 points)
- 4) How many grams of iron (III) nitrate could I make if I added a large excess of my limiting reagent? (3 points)

Gas Stoichiometry Pop Quiz

On a separate sheet of paper, answer the following questions using the equation below. Assume STP.



- 1) Balance the equation above. (1 point) **See equation above.**
- 2) How many liters of oxygen are required to make 12 liters of carbon dioxide? (3 points) **18 liters.**
- 3) How many liters of water vapor will be formed by the reaction of 15 grams of C₂H₆O and an excess of oxygen? (3 points) **7.3 liters.**
- 4) How many grams of carbon dioxide would be made in the reaction from problem #3? (3 points) **29 grams (28.7 grams without significant figures)**

Suggested Grading Scale

10 = A+

9 = A

8 = B

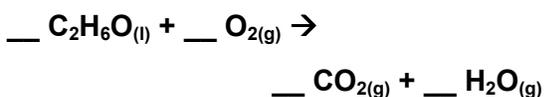
7 = C

6 = D

< 6 = F

Pop Quiz

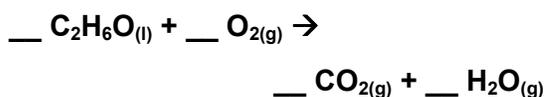
On a separate sheet of paper, answer the following questions using the equation below. Assume STP.



- 1) Balance the equation above. (1 point)
- 2) How many liters of oxygen are required to make 12 liters of carbon dioxide? (3 points)
- 3) How many liters of water vapor will be formed by the reaction of 15 grams of $\text{C}_2\text{H}_6\text{O}$ and an excess of oxygen? (3 points)
- 4) How many grams of carbon dioxide would be made in the reaction from problem #3? (3 points)

Pop Quiz

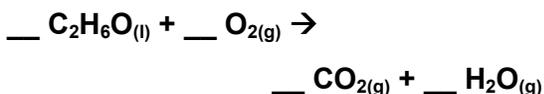
On a separate sheet of paper, answer the following questions using the equation below. Assume STP.



- 1) Balance the equation above. (1 point)
- 2) How many liters of oxygen are required to make 12 liters of carbon dioxide? (3 points)
- 3) How many liters of water vapor will be formed by the reaction of 15 grams of $\text{C}_2\text{H}_6\text{O}$ and an excess of oxygen? (3 points)
- 4) How many grams of carbon dioxide would be made in the reaction from problem #3? (3 points)

Pop Quiz

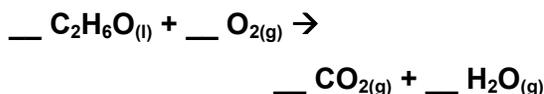
On a separate sheet of paper, answer the following questions using the equation below. Assume STP.



- 1) Balance the equation above. (1 point)
- 2) How many liters of oxygen are required to make 12 liters of carbon dioxide? (3 points)
- 3) How many liters of water vapor will be formed by the reaction of 15 grams of $\text{C}_2\text{H}_6\text{O}$ and an excess of oxygen? (3 points)
- 4) How many grams of carbon dioxide would be made in the reaction from problem #3? (3 points)

Pop Quiz

On a separate sheet of paper, answer the following questions using the equation below. Assume STP.



- 1) Balance the equation above. (1 point)
- 2) How many liters of oxygen are required to make 12 liters of carbon dioxide? (3 points)
- 3) How many liters of water vapor will be formed by the reaction of 15 grams of $\text{C}_2\text{H}_6\text{O}$ and an excess of oxygen? (3 points)
- 4) How many grams of carbon dioxide would be made in the reaction from problem #3? (3 points)

Phase Change Pop Quiz

Explain why substances change from the solid to liquid phase when you heat them. (10 points)

(Assign points based on how well you feel the student answers the question.)

The molecules in solids are held together with intermolecular forces such as hydrogen bonds, dipole-dipole forces, or London dispersion forces. When a substance is heated, this causes the molecules to move around more in their lattices. If the energy of movement becomes greater than the intermolecular forces holding the molecules together, the molecules will melt, allowing them greater freedom of motion.

Suggested Grading Scale

10 = A+

9 = A

8 = B

7 = C

6 = D

< 6 = F

Pop Quiz

Explain why substances change from the solid to liquid phase when you heat them. (10 points)

Pop Quiz

Explain why substances change from the solid to liquid phase when you heat them. (10 points)

Pop Quiz

Explain why substances change from the solid to liquid phase when you heat them. (10 points)

Pop Quiz

Explain why substances change from the solid to liquid phase when you heat them. (10 points)

Heat Calculations Pop Quiz

How much energy does it take to heat 125 grams of water from -15°C to 65°C ?
 $C_p [\text{H}_2\text{O}_{(s)}] = 2.03 \text{ J / g} \cdot ^{\circ}\text{C}$, $C_p [\text{H}_2\text{O}_{(l)}] = 4.18 \text{ J / g} \cdot ^{\circ}\text{C}$, $\Delta H_{\text{fusion}} = 6.00 \text{ kJ / mole}$.
(8 points)

Step 1: (2 points)

Heating the ice from -10°C to 0°C takes $(125 \times 15 \times 2.03) \text{ J} = 2,500 \text{ J}$

Step 2: (2 points)

Melting the ice takes $[(125 / 18.0) \times 6.00 \times 10^3] \text{ J} = 41,700 \text{ J}$

Step 3: (2 points)

Heating the water from 0°C to 65°C takes $(125 \times 65 \times 4.18) \text{ J} = 34,000 \text{ J}$

Step 4: (2 points)

The grand total = $2,500 \text{ J} + 41,700 \text{ J} + 34,000 \text{ J} = 78,200 \text{ J}$

Using the correct significant figures, this rounds to $78,000 \text{ J}$, or 78 kJ

Suggested Grading Scale

8 = A+

7 = B

6 = C

5 = D

< 5 = F

Pop Quiz

How much energy does it take to heat 125 grams of water from -15°C to 65°C ? $C_p [\text{H}_2\text{O}_{(s)}] = 2.03 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $C_p [\text{H}_2\text{O}_{(l)}] = 4.18 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $\Delta H_{\text{fusion}} = 6.00 \text{ kJ} / \text{mole}$. (8 points)

Pop Quiz

How much energy does it take to heat 125 grams of water from -15°C to 65°C ? $C_p [\text{H}_2\text{O}_{(s)}] = 2.03 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $C_p [\text{H}_2\text{O}_{(l)}] = 4.18 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $\Delta H_{\text{fusion}} = 6.00 \text{ kJ} / \text{mole}$. (8 points)

Pop Quiz

How much energy does it take to heat 125 grams of water from -15°C to 65°C ? $C_p [\text{H}_2\text{O}_{(s)}] = 2.03 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $C_p [\text{H}_2\text{O}_{(l)}] = 4.18 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $\Delta H_{\text{fusion}} = 6.00 \text{ kJ} / \text{mole}$. (8 points)

Pop Quiz

How much energy does it take to heat 125 grams of water from -15°C to 65°C ? $C_p [\text{H}_2\text{O}_{(s)}] = 2.03 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $C_p [\text{H}_2\text{O}_{(l)}] = 4.18 \text{ J} / \text{g} \cdot ^{\circ}\text{C}$, $\Delta H_{\text{fusion}} = 6.00 \text{ kJ} / \text{mole}$. (8 points)

Calorimetry Pop Quiz

When 12.5 grams of anthracene ($C_{14}H_{10}$) is burned in a bomb calorimeter with a 1750 mL water reservoir, the temperature of the water rises by $67.8^{\circ}C$. From this information, what is the molar heat of combustion of anthracene? $C_p(H_2O) = 4.184 J / g \cdot ^{\circ}C$. (12 points)

Give three points for each of the following:

- There are **0.070 moles of anthracene in the bomb**
- **$\Delta H = mC_p\Delta T$**
- **The amount of heat absorbed by the water is equal to $(1750 \times 4.184 \times 67.8) J = 496 kJ$**
- **Because 496 kJ is the amount of energy given off by 0.070 moles of anthracene, we can scale this up to determine that 7090 kJ are given off by one mole of anthracene. This is the molar heat of combustion of anthracene.**

(Note: This is very close to the actual heat of combustion for anthracene, which is 7064.8 kJ / mole).

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

7 = D

< 7 = F

Pop Quiz

When 12.5 grams of anthracene ($C_{14}H_{10}$) is burned in a bomb calorimeter with a 1750 mL water reservoir, the temperature of the water rises by $67.8^{\circ}C$. From this information, what is the molar heat of combustion of anthracene?
 $C_p(H_2O) = 4.184 J / g \cdot ^{\circ}C$. (12 points)

Pop Quiz

When 12.5 grams of anthracene ($C_{14}H_{10}$) is burned in a bomb calorimeter with a 1750 mL water reservoir, the temperature of the water rises by $67.8^{\circ}C$. From this information, what is the molar heat of combustion of anthracene?
 $C_p(H_2O) = 4.184 J / g \cdot ^{\circ}C$. (12 points)

Pop Quiz

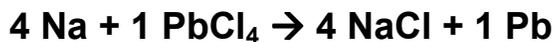
When 12.5 grams of anthracene ($C_{14}H_{10}$) is burned in a bomb calorimeter with a 1750 mL water reservoir, the temperature of the water rises by $67.8^{\circ}C$. From this information, what is the molar heat of combustion of anthracene?
 $C_p(H_2O) = 4.184 J / g \cdot ^{\circ}C$. (12 points)

Pop Quiz

When 12.5 grams of anthracene ($C_{14}H_{10}$) is burned in a bomb calorimeter with a 1750 mL water reservoir, the temperature of the water rises by $67.8^{\circ}C$. From this information, what is the molar heat of combustion of anthracene?
 $C_p(H_2O) = 4.184 J / g \cdot ^{\circ}C$. (12 points)

Hess's Law Quiz #1

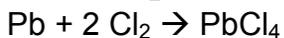
Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:



$$\Delta H = -411.2 \text{ kJ/mol}$$



$$\Delta H = -329.3 \text{ kJ/mol}$$

Scoring: Give two points for manipulating each of the equations correctly, two points for correctly adding the equations together, and two points for a correct final answer.

By manipulating the equations given, you can find that:



$$\Delta H = -1644.8 \text{ kJ/mol}$$



$$\underline{\Delta H = 329.3 \text{ kJ/mol}}$$



$$\Delta H = -1315.5 \text{ kJ/mol}$$

Suggested Grading Scale

8 = A+

7 = B+

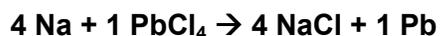
6 = C+

5 = D

< 5 = F

Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)

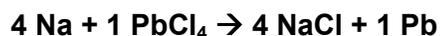


Given the following information:

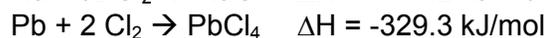


Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)

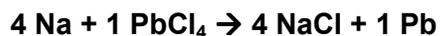


Given the following information:



Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)

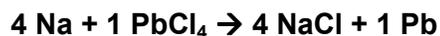


Given the following information:

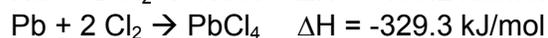


Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:



Hess's Law Pop Quiz #2

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:

Compound	ΔH_f° (kJ/mol)
AlF ₃	-1510.4
Al ₂ O ₃	-1675.7
NaF	-573.6
Na ₂ O	-414.2

$$\Delta H_{\text{rxn}} = \Sigma \Delta H_{\text{products}} - \Sigma \Delta H_{\text{reagents}} \text{ (3 points)}$$

In this case, this is equal to:

$$\begin{aligned} \Delta H_{\text{rxn}} &= [(6 \times -573.6) + (1 \times -1675.7)] - [(3 \times -414.2) + 2 \times -1510.4] \text{ kJ/mol} \\ &= [-3441.6 - 1675.7] - [-1242.6 - 3020.8] \text{ kJ/mol} \\ &= -853.9 \text{ kJ/mol} \end{aligned}$$

If they've plugged the numbers into the equation correctly, give them another three points. If the answer is correct, give them the final two points.

Suggested Grading Scale

8 = A+

7 = B+

6 = C+

5 = D

< 5 = F

Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:

Compound	ΔH_f° (kJ/mol)
AlF ₃	-1510.4
Al ₂ O ₃	-1675.7
NaF	-573.6
Na ₂ O	-414.2

Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:

Compound	ΔH_f° (kJ/mol)
AlF ₃	-1510.4
Al ₂ O ₃	-1675.7
NaF	-573.6
Na ₂ O	-414.2

Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:

Compound	ΔH_f° (kJ/mol)
AlF ₃	-1510.4
Al ₂ O ₃	-1675.7
NaF	-573.6
Na ₂ O	-414.2

Pop Quiz

Calculate the heat of reaction for the following reaction: (8 points)



Given the following information:

Compound	ΔH_f° (kJ/mol)
AlF ₃	-1510.4
Al ₂ O ₃	-1675.7
NaF	-573.6
Na ₂ O	-414.2

Entropy Pop Quiz

- 1) In your own words, define “entropy”. (3 points)
Entropy is a thermodynamic measurement of the randomness in a system.
- 2) Give two everyday examples of processes where entropy increases. (1 point each)
Any two everyday examples where randomness increases are fine.
- 3) Explain why the entropy of any system always higher at high temperature than at low temperature. (3 points)
Entropy is measured in units of $J / K \cdot mol$, meaning that the amount of entropy in a system is measured per number of degrees of temperature (in Kelvins). If we treat this like an equation, this means that the higher the temperature, the more entropy.

Suggested Grading Scale

8 = A+
7 = B+
6 = C+
5 = D
< 5 = F

Pop Quiz

- 1) In your own words, define “entropy”.
(3 points)

- 2) Give two everyday examples of processes where entropy increases.
(1 point each)
 -

 -

- 3) Explain why the entropy of any system always higher at high temperature than at low temperature.
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- 1) In your own words, define “entropy”.
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- 3) Explain why the entropy of any system always higher at high temperature than at low temperature.
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Pop Quiz

- 1) In your own words, define “entropy”.
(3 points)

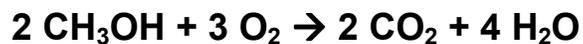
- 2) Give two everyday examples of processes where entropy increases.
(1 point each)
 -

 -

- 3) Explain why the entropy of any system always higher at high temperature than at low temperature.
(3 points)

Entropy Calculation Pop Quiz

Determine the entropy change for the following reaction: (6 points)



Compound	S (J / K · mol)
CH ₃ OH	127
CO ₂	214
H ₂ O	189
O ₂	205

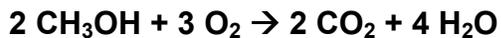
$$\begin{aligned} \Delta S &= \Sigma(\text{entropy of products}) - \Sigma(\text{entropy of reagents}) && \leftarrow 2 \text{ points} \\ &= [4(189) + 2(214)] - [2(127) + 3(205)] \text{ J / K} \cdot \text{mol} && \leftarrow 2 \text{ points} \\ &= 315 \text{ J / K} \cdot \text{mol} && \leftarrow 2 \text{ points} \end{aligned}$$

Suggested Grading Scale

6 = A+
5 = C+
4 = D
< 4 = F

Pop Quiz

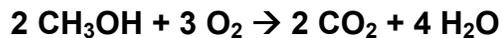
Determine the entropy change for the following reaction: (6 points)



Compound	S (J / K · mol)
CH ₃ OH	127
CO ₂	214
H ₂ O	189
O ₂	205

Pop Quiz

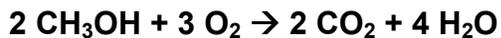
Determine the entropy change for the following reaction: (6 points)



Compound	S (J / K · mol)
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CO ₂	214
H ₂ O	189
O ₂	205

Pop Quiz

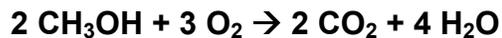
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Pop Quiz

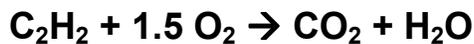
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Compound	S (J / K · mol)
CH ₃ OH	127
CO ₂	214
H ₂ O	189
O ₂	205

Entropy Calculation Pop Quiz

Acetylene gas burns in oxygen to form carbon dioxide and water:



If ΔH_{rxn} is -1300.5 kJ/mol and ΔS_{rxn} is $-211 \text{ J / K}\cdot\text{mol}$, will this reaction be spontaneous at a temperature of 600 K ? (6 points)

$$\begin{aligned} \Delta G &= \Delta H - T\Delta S && \leftarrow 2 \text{ points} \\ &= -1300.5 \text{ kJ/mol} - 600 \text{ K} (-0.211 \text{ kJ / K}\cdot\text{mol}) && \leftarrow 2 \text{ points} \\ &= -1173.9 \text{ kJ/mol} && \leftarrow 2 \text{ points} \end{aligned}$$

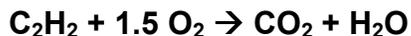
Because ΔG is negative, this reaction is spontaneous. $\leftarrow 2 \text{ points}$

Suggested Grading Scale

8 = A+
7 = B+
6 = C+
5 = D
< 5 = F

Pop Quiz

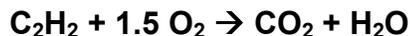
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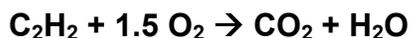
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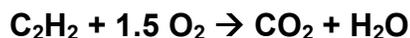
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If ΔH_{rxn} is -1300.5 kJ/mol and ΔS_{rxn} is $-211 \text{ J / K}\cdot\text{mol}$, will this reaction be spontaneous at a temperature of 600 K ? (6 points)

Kinetic Theory of Gases Pop Quiz

- 1) List two ways that real gases are different than ideal gases. (2 points each)

Any two of the following are acceptable answers:

- **Real gas molecules are not infinitely small. The particles have a very small volume.**
- **Real gas molecules don't move in random straight lines because they interact with the particles around them, causing them to be deflected even if intermolecular collisions don't take place.**
- **Real gas molecules interact with one another through London dispersion forces, as well as dipole-dipole forces and hydrogen bonding (for some molecules).**

- 2) Under what conditions of temperature and pressure do real gases most closely approximate ideal gases? (4 points)

Real gases most closely approximate ideal gases at high temperatures (2 points) and low pressures (2 points).

Suggested Grading Scale

8 = A+

7 = B+

6 = C+

5 = D

< 5 = F

Pop Quiz

- 1) List two ways that real gases are different than ideal gases. (2 points each)
 -
 -
- 2) Under what conditions of temperature and pressure do real gases most closely approximate ideal gases? (4 points)

Pop Quiz

- 1) List two ways that real gases are different than ideal gases. (2 points each)
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Pop Quiz

- 1) List two ways that real gases are different than ideal gases. (2 points each)
 -
 -
- 2) Under what conditions of temperature and pressure do real gases most closely approximate ideal gases? (4 points)

Gas Law Unit Conversions Pop Quiz

- 1) Convert 450 K to degrees Celsius. (2 points)
Because $^{\circ}\text{C} = \text{K} - 273$, the temperature is $450 - 273 = 177 \text{ K}$
- 2) Convert 1.20 atm to mm Hg. (2 points)
Because there are 760.0 mm Hg in 1.00 atm, the pressure in mm Hg is equal to $1.20 \text{ atm} \times 760.0 \text{ mm Hg} / \text{atm} = 912 \text{ mm Hg}$
- 3) Convert 95.0 kPa to atm. (2 points)
Because there are 101 kPa in 1.00 atm, the pressure in atm is equal to $(95.0 / 101) \text{ atm} = 0.941 \text{ atm}$.

Suggested Grading Scale

6 = A+
5 = B
4 = D+
< 4 = F

Pop Quiz

- 1) Convert 450 K to degrees Celsius. (2 points)
- 2) Convert 1.20 atm to mm Hg. (2 points)
- 3) Convert 95.0 kPa to atm. (2 points)

Pop Quiz

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Avogadro's Law Pop Quiz

Which sample contains a greater number of moles, a 1.00 liter sample of helium gas or a 2.00 liter sample of sulfur dioxide gas? Explain your answer based on your knowledge of Avogadro's law. (6 points)

Give two points for each of the following:

- **Avogadro's law states that $V = n$. Put another way, the volume of a sample of gas is directly proportional to the number of moles present.**
- **Because the volume of a gas depends on the number of moles of gas present, the sample with the higher volume must contain more moles of gas.**
- **The 2.00 L sample of sulfur dioxide contains a larger number of moles than the 1.00 L sample of helium.**

Suggested Grading Scale

6 = A+

5 = B

4 = D+

< 4 = F

Pop Quiz

Which sample contains a greater number of moles, a 1.00 liter sample of helium gas or a 2.00 liter sample of sulfur dioxide gas? Explain your answer based on your knowledge of Avogadro's law. (6 points)

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Boyle's Law Pop Quiz

- 1) If I blow up an air mattress at my home near sea level ($P = 1.00 \text{ atm}$) so that it has a volume of 125 L and take it camping at high altitude ($P = 0.825 \text{ atm}$), what will the volume of the mattress be when I get to my campsite? (6 points)

Give two points for each of the following:

- $P_1V_1 = P_2V_2$
- $(1.00 \text{ atm})(125 \text{ L}) = (0.825 \text{ atm})(x \text{ L})$
- $x = 152 \text{ L}$

- 2) A friend of mine who lives in the mountains told me that filling the tires of my car up to the very highest possible pressure will cause it to run better. Based on what you know about the behavior of gases, is this a good idea? Explain why or why not on the back of this paper. (6 points)

Give two points for each of the following:

- $P_1V_1 = P_2V_2$
- **Because atmospheric pressure at low altitudes is higher than the atmospheric pressure at high altitudes, the volume of the tires will decrease as you move down from the mountain. This decreased volume will put less stress on the tire.**
- **According to Boyle's Law, this is a safe thing to do.**

Note: If you've discussed Charles's law or the combined gas law, you may wish to point out that filling the automobile tires will cause the temperature of the tire to rise, causing the pressure to rise as well. Most likely, this would cause the tire to explode. If you have not discussed Charles's law or the combined gas law, this question is a good way to ease into it.

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

- 1) If I blow up an air mattress at my home near sea level ($P = 1.00 \text{ atm}$) so that it has a volume of 125 L and take it camping at high altitude ($P = 0.825 \text{ atm}$), what will the volume of the mattress be when I get to my campsite? (6 points)

- 2) A friend of mine who lives in the mountains told me that filling the tires of my car up to the very highest possible pressure will cause it to run better. Based on what you know about the behavior of gases, is this a good idea? Explain why or why not on the back of this paper. (4 points)

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Charles's Law Pop Quiz

- 1) A friend of mine who lives in Colorado was so excited to visit Cancun in January that he completely inflated his beach ball to a volume of 4.5 L ahead of time. If the temperature in Colorado was -5°C and the temperature in Cancun is 28°C , what will the volume of the beach ball be when he gets to Mexico? (6 points)

Give two points for each of the following:

- $V_1 / T_1 = V_2 / T_2$
- $4.5 \text{ L} / 268 \text{ K} = V_2 / 301 \text{ K}$
- $V_2 = 5.1 \text{ L}$

- 2) How full would he have needed to inflate the beach ball to ensure that the final volume would be exactly 4.5 L? (6 points)

Give two points for each of the following:

- $V_1 / T_1 = V_2 / T_2$
- $V_1 / 268 \text{ K} = 4.5 \text{ L} / 301 \text{ K}$
- $V_1 = 4.0 \text{ L}$

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

- 1) A friend of mine who lives in Colorado was so excited to visit Cancun in January that he completely inflated his beach ball to a volume of 4.5 L ahead of time. If the temperature in Colorado was -5°C and the temperature in Cancun is 28°C , what will the volume of the beach ball be when he gets to Mexico? (6 points)

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Combined Gas Law Pop Quiz

- 1) I know a really bad driver. One winter day he accidentally drove his car into the river. If the initial temperature inside the car was 25^o C and initial pressure was 1.00 atm, what was the final pressure inside his car at the bottom of the river if the temperature of the water was 2^o C? (6 points)

Give two points for each of the following:

- $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
- (1.00 atm / 298 K) = (x atm / 275 K)
- x = 0.923 atm

- 2) If his car initially had a volume of 4.50 x 10³ L, what was the volume of his car after the pressure of the water in the river squished it? Assume the water pressure was 1.75 atm. (6 points)

Give two points for each of the following:

- $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$
- [(1.00 atm)(4.5 x 10³ L)] / 298 K = [(1.75 atm)(x L)] / 275 K
- x = 2.37 x 10³ L

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

- 1) I know a really bad driver. One winter day he accidentally drove his car into the river. If the initial temperature inside the car was 25°C and initial pressure was 1.00 atm , what was the final pressure inside his car at the bottom of the river if the temperature of the water was 2°C ? (6 points)
- 2) If his car initially had a volume of $4.50 \times 10^3\text{ L}$, what was the volume of his car after the pressure of the water in the river squished it? Assume the water pressure was 1.75 atm . (6 points)

Pop Quiz

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Combined Gas Law Pop Quiz

- 1) A large refrigerator has an internal volume of 906 L. If the refrigerator is kept at atmospheric pressure (101 kPa) and contains 40.0 moles of air, what is the internal temperature of the refrigerator? $R = 8.31 \text{ L} \cdot \text{kPa} / \text{mol} \cdot \text{K}$ (6 points)

Give two points for each of the following:

- $PV = nRT$
- $(101 \text{ kPa})(906 \text{ L}) = (40.0 \text{ moles})(8.31 \text{ L} \cdot \text{kPa} / \text{mol} \cdot \text{K})(T)$
- $T = 275 \text{ K}$

- 2) If the temperature in the refrigerator changed such that it could hold 35.0 moles of air, would it be safe to keep potato salad in it? Explain your answer. (8 points)

Give two points for each of the following:

- $PV = nRT$
- $(101 \text{ kPa})(906 \text{ L}) = (35.0 \text{ moles})(8.31 \text{ L} \cdot \text{kPa} / \text{mol} \cdot \text{K})(T)$
- $T = 315 \text{ K}$
- **Because 315 K corresponds to a temperature of 42°C , which is well above room temperature, it would not be a very good idea to keep potato salad in it. Not if you were planning on eating it, anyway.**

Suggested Grading Scale

14 = A+

13 = A

12 = B+

11 = C+

10 = C

9 = D

< 9 = F

Pop Quiz

- 1) A large refrigerator has an internal volume of 906 L. If the refrigerator is kept at atmospheric pressure (101 kPa) and contains 40.0 moles of air, what is the internal temperature of the refrigerator? $R = 8.31 \text{ L} \cdot \text{kPa} / \text{mol} \cdot \text{K}$ (6 points)

- 2) If the temperature in the refrigerator changed such that it could hold 35.0 moles of air, would it be safe to keep potato salad in it? Explain your answer. (8 points)

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- 2) If the temperature in the refrigerator changed such that it could hold 35.0 moles of air, would it be safe to keep potato salad in it? Explain your answer. (8 points)

Dalton's Law of Partial Pressures Pop Quiz

A container holds 2.0 moles of argon, 3.0 moles of nitrogen, and 5.0 moles of carbon dioxide at a pressure of 1.8 atm.

- 1) What is the mole fraction of argon in the container? (4 points)

Give two points for each of the following:

- $x_a = n_a / (n_a + n_b + n_c)$ or $x_{Ar} = n_{Ar} / (n_{Ar} + n_{N_2} + n_{CO_2})$
- $x_{Ar} = 2.0 / 10.0 = 0.20$

- 2) What is the partial pressure of argon in the container? (4 points)

Give two points for each of the following:

- $P_a = x_A P_{Tot}$ or $P_{Ar} = x_{Ar} P_{Tot}$
- $P_{Ar} = (0.20)(1.8 \text{ atm}) = 0.36 \text{ atm}$

- 3) There is an identical container containing only argon gas with the same partial pressure that you calculated in #2. When the containers are connected, what will the partial pressure of argon be? Explain. (4 points)

The partial pressure of argon will be identical to the partial pressure of argon in the first container. After all, when we work with partial pressures we treat each gas as if it had no interactions with any other gases. As a result, joining the two containers has no effect on the partial pressure of argon. It will, however, have an effect on the mole fraction of argon and on both the partial pressures and mole fractions of the other gases present.

Suggested Grading Scale

- 12 = A+
- 11 = A
- 10 = B
- 9 = C+
- 8 = D+
- < 8 = F

Pop Quiz

A container holds 2.0 moles of argon, 3.0 moles of nitrogen, and 5.0 moles of carbon dioxide at a pressure of 1.8 atm.

- 1) What is the mole fraction of argon in the container? (4 points)
- 2) What is the partial pressure of argon in the container? (4 points)
- 3) There is an identical container containing only argon gas with the same partial pressure that you calculated in #2. When the containers are connected, what will the partial pressure of argon be? Explain. (4 points)

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Gas Laws Vocabulary Pop Quiz

Define the following terms: (3 points each)

- mole fraction: **The fraction of the number of moles in a gas that is directly attributable to any one of those gases. Mole fraction is equal to the partial pressure of the gas of interest divided by the total pressure of the mixture of gases.**
- ideal gas: **A nonexistent gas in which the particles have completely elastic collisions, no intermolecular interactions, and the kinetic energy is proportional to temperature.**
- partial pressure: **The amount of pressure in a mixture of gases that is directly attributable to any one of those gases. The partial pressure of a gas can be calculated by multiplying the mole fraction of the gas by the total pressure of the mixture of gases.**
- STP: **Standard temperature and Pressure, equivalent to 273 K (273⁰ C) and 1 atm (101 kPa, 760 mm Hg).**

Suggested Grading Scale

12 = A+

11 = A

10 = B

9 = C+

8 = D+

< 8 = F

Pop Quiz

Define the following terms: (3 points each)

- mole fraction:

- ideal gas:

- partial pressure:

- STP:

Pop Quiz

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Root Mean Square Velocity Pop Quiz

- 1) Define rms velocity: (3 points)

Root mean square velocity is frequently defined as being the same as the average speed of the molecules of a gas. rms velocity is actually defined as the square root of the average of the squares of all the particles in the gas. Generally, the average speed of the particles is equal to 0.921 x the rms velocity.

- 2) What is the rms velocity of ethane (C_2H_6) molecules at a temperature of $25^{\circ}C$? $R = 8.31 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$. (4 points)

The rms velocity is equal to $(3RT/M)^{1/2} = [(3 \times 8.31 \times 298) / 0.30]^{1/2}$ or $u_{\text{rms}} = 157 \text{ m} / \text{sec}$

Suggested Grading Scale

7 = A+

6 = B+

5 = C

4 = D

< 4 = F

