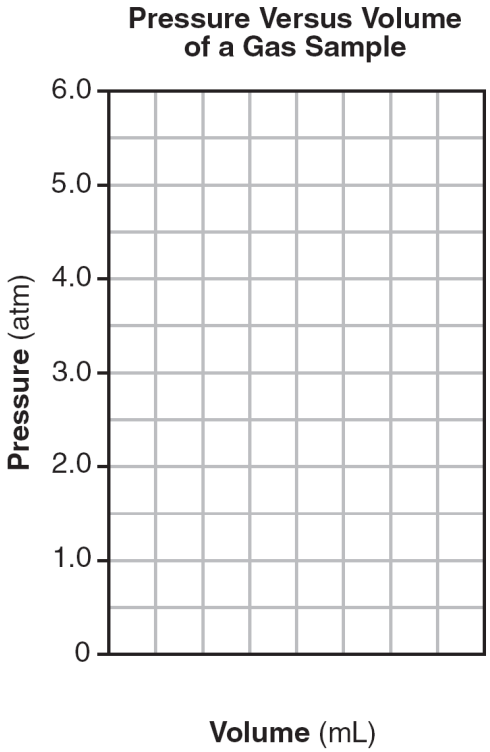
Quarter 3 exam SA Review

Base your answers to questions **1** through **3** on the information below

A gas sample is held at constant temperature in a closed system. The volume of the gas is changed, which causes the pressure of the gas to change. Volume and pressure data are shown in the table below.

Volume and Pressure of a Gas Sample

Volume (mL)	**Pressure** (atm)
1200	0.5
600	1.0
300	2.0
150	4.0
100	6.0



1. On the grid above, mark an appropriate scale on the axis labeled "Volume (mL)."
2. On the same grid, plot the data from the table. Circle and connect the points.
3. Based on your graph, what is the pressure of the gas when the volume of the gas is 200. milliliters?

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4. Explain, in terms of collision theory, why the rate of a chemical reaction increases with an increase in temperature.
5. Determine the percent composition by mass of oxygen in the compound $C_6H_{12}O_6$

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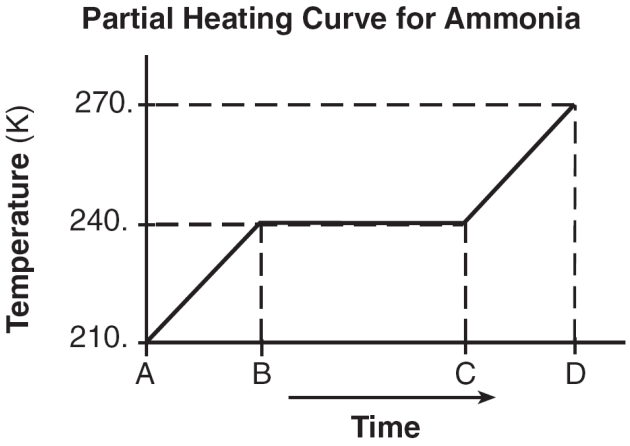
Base your answers to questions **6** through **8** on the information below

A 5.00-gram sample of liquid ammonia is originally at 210. K. The diagram of the partial heating curve below represents the vaporization of the sample of ammonia at standard pressure due to the addition of heat. The heat is *not* added at a constant rate.



Some physical constants for ammonia are shown in the data table below.

Some Physical Constants for Ammonia

specific heat capacity of $NH_3(\ell)$	4.71 J/g•K
heat of fusion	332 J/g
heat of vaporization	1370 J/g

6. Calculate the total heat absorbed by the 5.00-gram sample of ammonia during time interval AB. Your response must include *both* a correct numerical setup and the calculated result.

7. Describe what is happening to *both* the potential energy and the average kinetic energy of the molecules in the ammonia sample during time interval BC. Your response must include both potential energy and average kinetic energy.

8. Determine the total amount of heat required to vaporize this 5.00-gram sample of ammonia at its boiling point.

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9. Base your answer to the following question on the information below

The unbalanced equation below represents the decomposition of potassium chlorate.

$KClO_3(s) \rightarrow KCl(s) + O_2(g)$

Balance the equation *below*, using the smallest whole-number coefficients.

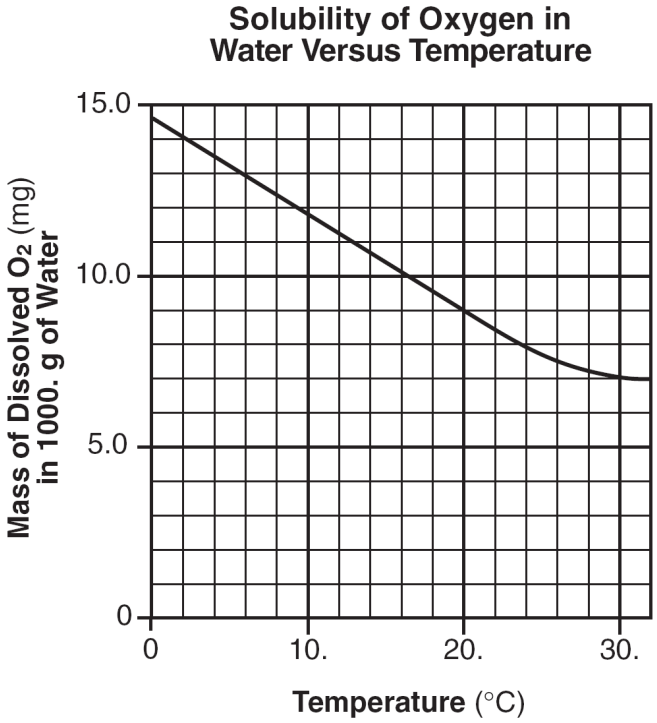
$$\_\_\_\_\_\ KClO_3(s) \rightarrow \_\_\_\_\_\ KCl(s) + \_\_\_\_\_\ O_2(g)$$

10. Explain, in terms of electronegativity, why a P–Cl bond in a molecule of PCl_5 is more polar than a P–S bond in a molecule of P_2S_5.

11. A 1.00-mole sample of neon gas occupies a volume of 24.4 liters at 298 K and 101.3 kilopascals. Calculate the density of this sample. Your response must include *both* a correct numerical setup and the calculated result.

Base your answers to questions **12** through **14** on the information below

Scientists who study aquatic ecosystems are often interested in the concentration of dissolved oxygen in water. Oxygen, O2, has a very low solubility in water, and therefore its solubility is usually expressed in units of milligrams per 1000. grams of water at 1.0 atmosphere. The graph below shows a solubility curve of oxygen in water.



12. A student determines that 8.2 milligrams of oxygen is dissolved in a 1000.-gram sample of water at 15°C and 1.0 atmosphere. In terms of saturation, what type of solution is this sample?

13. Explain, in terms of molecular polarity, why oxygen gas has low solubility in water. Your response must include *both* oxygen and water.

14. An aqueous solution has 0.0070 gram of oxygen dissolved in 1000. grams of water. Calculate the dissolved oxygen concentration of this solution in parts per million. Your response must include *both* a correct numerical setup and the calculated result.

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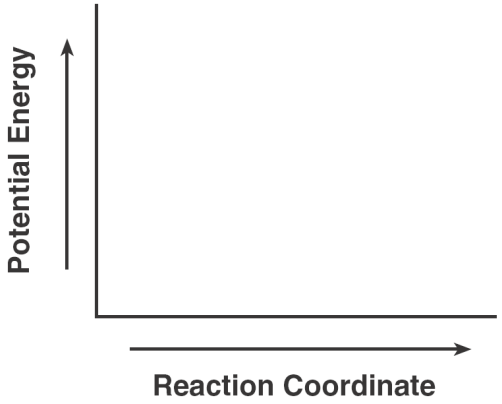
Base your answers to questions **15** through **18** on

Propane is a fuel that is sold in rigid, pressurized cylinders. Most of the propane in a cylinder is liquid, with gas in the space above the liquid level. When propane is released from the cylinder, the propane leaves the cylinder as a gas. Propane gas is

$C_3H8(g) + 5O_2(g) \rightarrow 2CO_2(g) + 4H_2O(\ell) + 2219.2kJ$

A small amount of methanethiol, which has a distinct odor, is added to the propane to help consumers detect a propane leak. In methanethiol, the odor is caused by the thiol functional group (–SH). Methanethiol, CH3SH, has a structure that is very similar to the structure of methanol.



15. Draw a particle diagram to represent propane in a pressurized cylinder. Your response must include *at least six* molecules of propane in the gas phase and *at least six* molecules of propane in the liquid phase.

16. On the diagram *above*, draw a potential energy diagram for this reaction.

17. Determine the total amount of energy released when 2.50 moles of propane is completely reacted with oxygen.

18. In the space *below*, draw a structural formula for a molecule of methanethiol.

Base your answers to questions **19** through **22** on the information below

The table below lists physical and chemical properties of six elements at standard pressure that correspond to known elements on the Periodic Table. The elements are identified by the code letters, D, E, G, J, L, and Q.

Properties of Six Elements at Standard Pressure

Element D Density 0.00018 g/cm^3 Melting point –272°C Boiling point –269°C Oxide formula (none)	Element E Density 1.82 g/cm^3 Melting point 44°C Boiling point 280°C Oxide formula E_2O_5	Element G Density 0.53 g/cm^3 Melting point 181°C Boiling point 1347°C Oxide formula G_2O
Element J Density 0.0013 g/cm^3 Melting point –210°C Boiling point –196°C Oxide formula J_2O_5	Element L Density 0.86 g/cm^3 Melting point 64°C Boiling point 774°C Oxide formula L_2O	Element Q Density 0.97 g/cm^3 Melting point 98°C Boiling point 883°C Oxide formula Q_2O

19. What is the total number of elements in the "Properties of Six Elements at Standard Pressure" table that are solids at STP?

20. An atom of element G *is in the ground state. What is the total number of valence electrons in this atom?*

21. Letter Z *corresponds to an element on the Periodic Table other than the six listed elements. Elements G, Q, L, and Z are in the same group on the Periodic Table, as shown in the diagram below.*

G

Q

L

Z

Based on the trend in the melting points for elements G, Q, and L listed in the "Properties of Six Elements at Standard Pressure" table, estimate the melting point of element Z, in degrees Celsius.

22. Identify, by code letter, the element that is a noble gas in the "Properties of Six Elements at Standard Pressure" table.

Base your answers to questions **23** through **25** on the information below

Ozone gas, O_3, can be used to kill adult insects in storage bins for grain without damaging the grain. The ozone is produced from oxygen gas, O_2, in portable ozone generators located near the storage bins. The concentrations of ozone used are so low that they do not cause any environmental damage. This use of ozone is safer and more environmentally friendly than a method that used bromomethane, CH_3Br. However, bromomethane was more effective than ozone because CH_3Br killed immature insects as well as adult insects.

Adapted From: The Sunday Gazette(Schenectady, NY) 3/9/03

23. Determine the total number of moles of CH_3Br in 19 grams of CH_3Br (gram-formula mass = 95 grams/mol).

24. Given the balanced equation for producing bromomethane.

$$Br_2 + CH_4 \rightarrow CH_3Br + HBr$$

Identify the type of organic reaction shown.

25. Based on the information in the passage, state one advantage of using ozone instead of bromomethane for insect control in grain storage bins.

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26. In living organisms, the ratio of the naturally occurring isotopes of carbon, C-12 to C-13 to C-14, is fairly consistent. When an organism such as a woolly mammoth died, it stopped taking in carbon, and the amount of C-14 present in the mammoth began to decrease. For example, one fossil of a woolly mammoth is found to have 1/32 of the amount of C-14 found in a living organism.

State, in terms of subatomic particles, how an atom of C-13 is different from an atom of C-12.