

This exam consists of four pages. Make sure you have one of each. Print your name at the top of each page now. A fifth page contains a periodic chart and other information you may need. You may tear this sheet off and use it for scratch paper. Show your work on calculations, be sure to include units in the calculations, and give answers to the correct number of significant figures. You may use atomic weight values rounded to the nearest 0.1 amu.

Page **Points**

1 _____

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If anything confuses you or is not clear, raise your hand and ask!

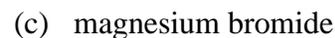
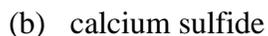
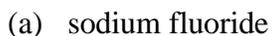
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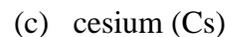
(6) 1. Name the following molecular compounds:



(6) 2. Give the empirical formula for the following ionic compounds:



(6) 3. Identify the **family** (i.e. alkali metal, alkaline earth metal, transition metal, halogen, oxygen family, nitrogen family, carbon family) to which each of the following elements belong:



(9) 4. Give the number of **protons**, **neutrons**, and **electrons** in each of the following atoms or ions:

Atom or Ion	# of protons	# of neutrons	# of electrons
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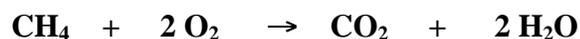


- (4) 5. Of the following components of the atmosphere, **circle** the component present in the greatest quantity, and **underline** the component present in least quantity:
oxygen, nitrogen, carbon dioxide, argon
- (2) 6. Of the gases listed in question 5, which are **elements**?
- (2) 7. Of the gases listed in question 5, which are **monatomic**?
- (3) 8. Of the following components found in the **troposphere** circle the ones that are considered pollutants.
CO₂, CO, O₂, O₃, H₂O, NO, SO₂
- (4) 9. Of the pollutants identified in question 8
(a) Which is (are) produced primarily by burning coal in power plants?
(b) Which is (are) produced primarily by automobiles?
- (2) 10. O₃ and O₂ are two forms of the element oxygen that are referred to as:
(circle one: **isotopes**, **aerosols**, **allotropes**, **halogens**)
- (6) 11. Draw Lewis dot structures of O₃ and O₂.
- (6) 12. In each of the following pairs, circle the form of electromagnetic radiation that has the **shorter wavelength**.
(a) microwaves and ultraviolet
(b) infrared and visible
(c) X-rays and gamma rays

- (3) 13. Calculate the **frequency** (ν) of a beam of green light with a wavelength (**8**) 515 nm. (The velocity of light, **c** is $3.00 \times 10^8 \text{ ms}^{-1}$).
- (4) 14. Name two **greenhouse** gases. Which form of electromagnetic radiation do they interact with principally, and how does this interaction contribute to an increase in global temperature?
- (4) 15. Although ozone could be classified as a greenhouse gas, it contributes little to the greenhouse effect because of its relatively low concentration. What is its main effect in the **stratosphere**, and why is a decrease in ozone concentrations there considered a problem?
- (3) 16. Of the following forms of electromagnetic radiation, circle those forms with enough energy per photon to break a chemical bond:
microwave, gamma ray, radio wave, ultraviolet, infrared, X-ray
- (8) 17. Draw Lewis dot structures for NF_3 and BF_3 . What is the **molecular geometry** of each?
- (4) 18. What is the difference between a **molecular formula** and a **structural formula**?

(6) 19. One of the components of gasoline is **octane** (C_8H_{18}). Write a balanced chemical equation describing the **complete combustion** of octane.

(5) 20. Marsh gas (methane, CH_4) is a component of natural gas and is produced by bacterial activity in marshes and bogs. Following is the equation for its combustion. (Show your work on calculations).



(a) What is the % carbon in methane?

(b) How many moles of water are produced by combustion of 15 moles of methane?

(c) How many kg of CO_2 are produced by the combustion of 25 kg of methane?

(3) 21. Avogadro's number (N) has the value 6.02×10^{23} . Circle below the correct units for N.

grams/mole, moles/gram, molecules/gram, molecules/mole, moles/molecule

(4) 22. Radiation of a wavelength of 220 nm is said to have enough energy to break a chemical bond. Calculate:

(a) The energy in Joules of a photon of this wavelength. ($h = 6.63 \times 10^{-34} \text{ Js}$)

(b) The energy of **a mole of photons** of this wavelength.