

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

# NOVA: Hunting the Elements

## Part 1: Basic Chemistry

### Blank Periodic Table

Fill in the parts of this periodic table covered by the documentary.

hydrogen 1 <b>H</b> 1.0079																	helium 2 <b>He</b> 4.0026	
lithium 3 <b>Li</b> 6.941	beryllium 4 <b>Be</b> 9.0122											boron 5 <b>B</b> 10.811	carbon 6 <b>C</b> 12.011	nitrogen 7 <b>N</b> 14.007	oxygen 8 <b>O</b> 15.999	fluorine 9 <b>F</b> 18.998	neon 10 <b>Ne</b> 20.180	
sodium 11 <b>Na</b> 22.990	magnesium 12 <b>Mg</b> 24.305											aluminum 13 <b>Al</b> 26.982	silicon 14 <b>Si</b> 28.086	phosphorus 15 <b>P</b> 30.974	sulfur 16 <b>S</b> 32.065	chlorine 17 <b>Cl</b> 35.453	argon 18 <b>Ar</b> 39.948	
potassium 19 <b>K</b> 39.098	calcium 20 <b>Ca</b> 40.078	scandium 21 <b>Sc</b> 44.956	titanium 22 <b>Ti</b> 47.867	vanadium 23 <b>V</b> 50.942	chromium 24 <b>Cr</b> 51.996	manganese 25 <b>Mn</b> 54.938	iron 26 <b>Fe</b> 55.845	cobalt 27 <b>Co</b> 58.933	nickel 28 <b>Ni</b> 58.693	copper 29 <b>Cu</b> 63.546	zinc 30 <b>Zn</b> 65.39	gallium 31 <b>Ga</b> 69.723	germanium 32 <b>Ge</b> 72.61	arsenic 33 <b>As</b> 74.922	selenium 34 <b>Se</b> 78.96	bromine 35 <b>Br</b> 79.904	krypton 36 <b>Kr</b> 83.80	
rubidium 37 <b>Rb</b> 85.468	strontium 38 <b>Sr</b> 87.62	yttrium 39 <b>Y</b> 88.906	zirconium 40 <b>Zr</b> 91.224	niobium 41 <b>Nb</b> 92.906	molybdenum 42 <b>Mo</b> 95.94	technetium 43 <b>Tc</b> [98]	ruthenium 44 <b>Ru</b> 101.07	rhodium 45 <b>Rh</b> 102.91	palladium 46 <b>Pd</b> 106.42	silver 47 <b>Ag</b> 107.87	cadmium 48 <b>Cd</b> 112.41	indium 49 <b>In</b> 114.82	tin 50 <b>Sn</b> 118.71	antimony 51 <b>Sb</b> 121.76	tellurium 52 <b>Te</b> 127.60	iodine 53 <b>I</b> 126.90	xenon 54 <b>Xe</b> 131.29	
caesium 55 <b>Cs</b> 132.91	barium 56 <b>Ba</b> 137.33	57-70 *	lutetium 71 <b>Lu</b> 174.97	hafnium 72 <b>Hf</b> 178.49	tantalum 73 <b>Ta</b> 180.95	tungsten 74 <b>W</b> 183.84	rhenium 75 <b>Re</b> 186.21	osmium 76 <b>Os</b> 190.23	iridium 77 <b>Ir</b> 192.22	platinum 78 <b>Pt</b> 195.08	gold 79 <b>Au</b> 196.97	mercury 80 <b>Hg</b> 200.59	thallium 81 <b>Tl</b> 204.38	lead 82 <b>Pb</b> 207.2	bismuth 83 <b>Bi</b> 208.98	polonium 84 <b>Po</b> [209]	astatine 85 <b>At</b> [210]	radon 86 <b>Rn</b> [222]
francium 87 <b>Fr</b> [223]	radium 88 <b>Ra</b> [226]	89-102 * *	lawrencium 103 <b>Lr</b> [262]	rutherfordium 104 <b>Rf</b> [261]	dubnium 105 <b>Db</b> [262]	seaborgium 106 <b>Sg</b> [266]	bohrium 107 <b>Bh</b> [264]	hassium 108 <b>Hs</b> [269]	meitnerium 109 <b>Mt</b> [268]	ununnium 110 <b>Uun</b> [271]	ununium 111 <b>Uuu</b> [272]	ununium 112 <b>Uub</b> [277]	ununquadium 114 <b>Uuq</b> [289]					

\* Lanthanide series

lanthanum 57 <b>La</b> 138.91	cerium 58 <b>Ce</b> 140.12	praseodymium 59 <b>Pr</b> 140.91	neodymium 60 <b>Nd</b> 144.24	promethium 61 <b>Pm</b> [145]	samarium 62 <b>Sm</b> 150.36	europium 63 <b>Eu</b> 151.96	gadolinium 64 <b>Gd</b> 157.25	terbium 65 <b>Tb</b> 158.93	dysprosium 66 <b>Dy</b> 162.50	holmium 67 <b>Ho</b> 164.93	erbium 68 <b>Er</b> 167.26	thulium 69 <b>Tm</b> 168.93	ytterbium 70 <b>Yb</b> 173.04
actinium 89 <b>Ac</b> [227]	thorium 90 <b>Th</b> 232.04	protactinium 91 <b>Pa</b> 231.04	uranium 92 <b>U</b> 238.03	neptunium 93 <b>Np</b> [237]	plutonium 94 <b>Pu</b> [244]	americium 95 <b>Am</b> [243]	curium 96 <b>Cm</b> [247]	berkelium 97 <b>Bk</b> [247]	californium 98 <b>Cf</b> [251]	einsteinium 99 <b>Es</b> [252]	fermium 100 <b>Fm</b> [257]	mendelevium 101 <b>Md</b> [258]	nobelium 102 <b>No</b> [259]

\*\* Actinide series

### Gold - Au

- Write the number of subatomic particles in gold:
  - Protons:
  - Neutrons:
  - Electrons:
- Give one property of gold.
- How much gold is in one ton of the mined rock?

4. How much is each truckload of ore worth, once the gold is extracted?
5. What determines how reactive an element is?
6. Write and color code the noble metals on the blank periodic table.
7. Why is gold so heavy?

## **Copper - Cu**

8. Write the number of subatomic particles in copper:
  - a. Protons:
  - b. Neutrons:
  - c. Electrons:
9. List three uses of copper.
10. Give one property of copper.

## **The Alloy**

11. What alloy does tin make when mixed with copper?
12. How are atoms arranged in pure metals?
13. Why isn't pure copper used for bells instead of bronze?

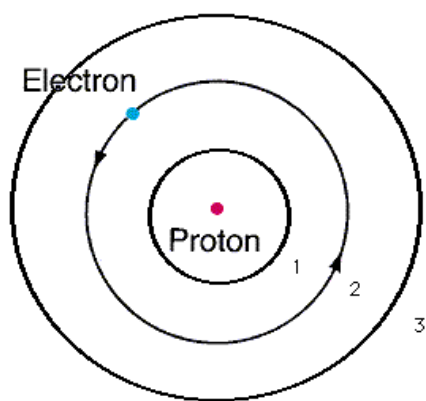
## Electron Microscope

14. How much would you have to zoom in on a map of the United States to replicate the power of an electron microscope?
15. Why is the microscope wrapped in acoustic blankets?
16. What part of the atom is actually visible under the microscope?
17. What do protons determine about an element?
18. What is the number of protons called?
19. Label the atomic number, symbol, and atomic mass of calcium below:

20
Ca
Calcium
40.08

20. Give an example of a real-life object made from each of the following elements:
  - a. Calcium –
  - b. Bismuth –
  - c. Bromine –
21. What is a family of elements?
22. Where did the noble gases get their name?
23. What do electrons determine?

24. How many electrons can fill each of the orbital levels in the diagram below?



### Chlorine - Cl

25. Give the number of atomic particles in chlorine:

- a. Protons –
- b. Neutrons –
- c. Electrons –

26. Chlorine wants to ( take / give away ) one electron, becoming an ( ion / isotope ).

27. Why do alkali metals and halogens react so strongly with other elements?

28. What do sodium and chlorine make when combined?

29. Compare the properties of each of the following:

	Sodium (Na)	Chlorine (Cl)	Sodium Chloride (NaCl)
State of Matter			
Reactive or Stable			
Practical Use			

## Oxygen - O

30. What is ANFO?

31. What do each of the spikes on the ion chromatograph represent?

32. This is the chemical reaction of the ANFO explosion. Explain what happens during this reaction to release so much heat energy.



33. Write the chemical equation for the burning candle.

34. Write the chemical equation for the formation of rust.

35. Compare the speed and explosive force of gunpowder, emulsion-gel, and C4. Which is the fastest? Explain why.

# NOVA: Hunting the Elements

## Part 2: Chemistry of Life, Rare Earth Elements, and Radioactivity

### Elements of Life

1. List the six most common elements of life, a common object they are found in, and an important property.

Element Symbol	Element Name	Common Object	Important Property
C			
H			
N			
O			
P			
S			

2. What can happen when excessive trace elements are lost from the body?
3. Describe a body function or part that utilizes each of these trace elements:
  - a. Calcium –
  - b. Iron –
  - c. Potassium –
  - d. Zinc –
  - e. Magnesium –
  - f. Sodium –

4. What conditions did the earliest bacteria need for energy production?
5. What do cyanobacteria use for energy production? What do they release as waste?
6. In the core sample collected from Yellowstone, which layer is the cyanobacteria?

## **Origin of the Elements**

7. What is the origin of hydrogen, the smallest element?
8. Describe the process of fusion and how it produces helium.
9. What happens when a star runs low on hydrogen fuel?
10. What is created in supernova explosion?

## **Silicon and Glass**

11. What elements is sand made of?
12. What is added to Gorilla Glass to make it stronger than normal glass?

## **Rare Earth Elements**

13. Where do most of the rare earth elements come from?
14. How are the fifteen rare earth elements chemically similar?

15. What elements are rare earth magnets usually made of?

16. Why are rare earth elements in such short supply?

17. How do sharks react to rare earth metals?

18. Describe the following parts of the lemon shark experiment:

Independent Variable –

Dependent Variable –

Experimental Group –

Control Group –

## Carbon Isotopes

19. What is the difference between the compositions of these carbon isotopes?

	<b>Protons</b>	<b>Electrons</b>	<b>Neutrons</b>
<b>Carbon-12</b>			
<b>Carbon-13</b>			
<b>Carbon-14</b>			

20. What happens to Carbon-14 over time?

21. Define radioactive half-life:

22. Based on carbon dating, how long ago did the tree die?



## Nuclear Radiation

23. Give the number of subatomic particles in uranium:
- Protons –
  - Neutrons –
  - Electrons –
24. How is the mousetrap simulation similar to a fission chain reaction?
25. What element was used as fuel for the “Little Boy” bomb?
26. What element was used as fuel for the “Fat Man” bomb?
27. The scientists at Lawrence Livermore Lab have been able to produce 6 new, synthetic elements. Why isn't there yet a practical use for these elements?