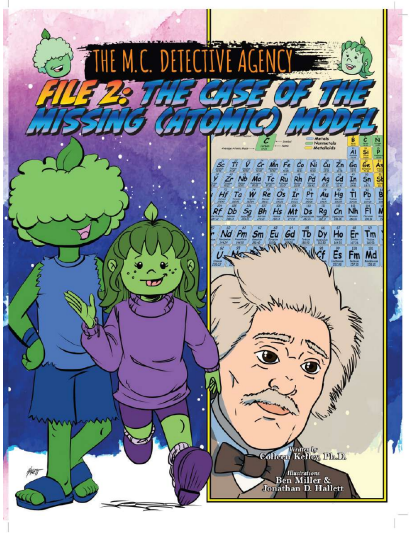
Intermediate Lesson Plans
Grades 6 – 8

9 x 40-minute lessons **SAMPLE**

BEFORE YOU

Begin

ITEMS TO PREPARE



Intermediate Lesson Plans

- Print 3 copies of the Kids' Chemical Solutions Periodic Table of Elements (next page) for each student. OR Print and laminate 1 copy of the Kids' Chemical Solutions Periodic Table of Elements to be shared and re-used with pairs of students.
-
- Each student will need a notebook and a pencil/eraser (not included in the kit).
-
- You will need to assemble the Atomic Bingo game. Everything you need is included in a FREE PDF available at the Hewitt Learning website under Kids' Chemical Solutions.

Periodic Table of the Elements

	1	2		3	4	5	6	7	8
1	1 H Hydrogen 1.01								2 He Helium 4.00
2	3 Li Lithium 6.94	4 Be Beryllium 9.01		5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
3	11 Na Sodium 22.99	12 Mg Magnesium 24.31		13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
4	19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 97.00	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
6	55 Cs Cesium 132.91	56 Ba Barium 137.33	* 57-70	71 Lu Lutetium 174.97	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.20	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.00	83 Bi Bismuth 208.98	84 Po Polonium 208.93	85 At Astatine 209.99	86 Rn Radon 222.02
7	87 Fr Francium 223.02	88 Ra Radium 226.03	** 89-102	103 Lr Lawrencium 266.12	104 Rf Rutherfordium 267.12	105 Db Dubnium 268.13	106 Sg Seaborgium 269.13	107 Bh Bohrium 270.13	108 Hs Hassium 269.13	109 Mt Meitnerium 277.15	110 Ds Darmstadtium 282.16	111 Rg Roentgenium 282.17	112 Cn Copernicium 286.18	113 Nh Nihonium 286.18	114 Fl Flerovium 290.19	115 Mc Moscovium 290.20	116 Lv Livermorium 293	117 Ts Tennessine [illegible]	118 Og Oganesson 295.22

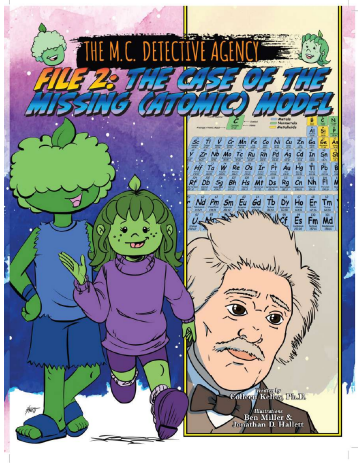
*	57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.40	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05
**	89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 232.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium 252.08	100 Fm Fermium 257.10	101 Md Mendelevium 258.10	102 No Nobelium 259.10

Atomic Number — 6
Symbol — C
Name — Carbon
Average Atomic Mass — 12.01

Metals
Nonmetals
Metalloids

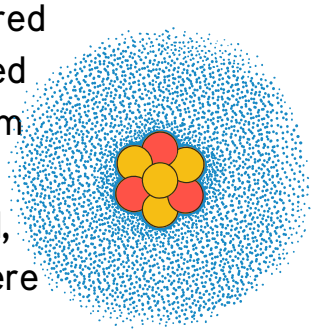
FILE 2 OVERVIEW

Intermediate Lesson Plans

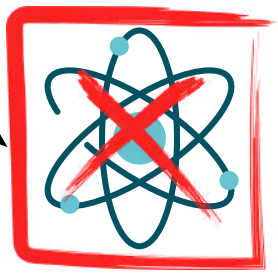


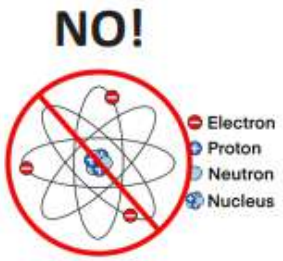
Overview:

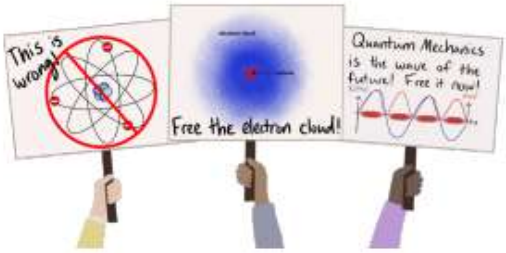
In 1927, a bunch of the smartest scientists in the world gathered in Belgium to debate the structure of the atom. This debate led to the structure of the atom we embrace today - the Quantum Mechanical model of the atom. This model says that the electrons exist on the exterior in a nebulous, undefined cloud, like the image shown with the blue cloud. It also says that there is a teeny, tiny particle in the center that is called a nucleus. Inside the nucleus are crammed in protons and neutrons.



The structure that looks like this one was proven to be absolute hogwash. NEVER should it be used to represent an atom. We've known better for 100 years!







At the 1927 Solvay Conference in Belgium, these scientists debated the correct model to represent the structure of the atom. This was the result and still holds true today.

This sequence of 9 lessons associated with File 2: The Case of the Missing (Atomic) Model are design to impart an understanding of the structure and substructure of an atom.

LESSON 1 40 MINUTES

Intermediate Lesson Plans

Description:

This lesson is focused on understanding the numbers found in each individual box on the Periodic Table of Elements. Students will gain an understanding of these terms:

- **atomic number,**
- **atomic mass,**
- **protons,**
- **neutrons,**
- **electrons,**
- **electron cloud, and**
- **nucleus.**

Activity Outcomes:

- **Students will be able to round an atomic mass to its nearest whole number and understand that this number represents the majority of atoms of this element.**
- **Students will be able to calculate the number of protons, neutrons, and electrons of an atom of a given element.**
- **Students will use their understanding of the terms atomic number and atomic mass to complete a table.**

Materials Needed:

1. Each student will need a pencil, eraser, and a notebook.
2. Each student will need access to the Kids' Chemical Solutions Periodic Table of the Elements found on page 3.
3. Each student will need access to the Kids' Chemical Solutions Activity Packet File 2: The Case of the Missing (Atomic) Model.
4. The teacher should read these pages from the Kids' Chemical Solutions Activity Packet File 2: The Case of the Missing (Atomic) Model.
    a. Tell Me More...about the friendship between Albert Einstein and Marie Curie
    b. Tell Me More...about The Solvay Conferences

Setup for Activities 1 and 2:

- Each student will need a pencil, eraser, and a notebook.
- Each student will need access to the Kids' Chemical Solutions Periodic Table of the Elements found on page
- Each student will need access to the Kids' Chemical Solutions Activity Packet File 2: The Case of the Missing (Atomic) Model.
- Students can work alone or in groups of 2 or 3.

Activity 1 (15 minutes)

- Activity/Questions/Instructions
    - Ask students to read all four pages of Ray's Rules found in the Activity Packet.
    - Students will write a 2 - 4 sentence summary of each of these pages in their notebooks.
- Conclusion/Wrap-up
    - When all groups are done have each group verbally share their summary from one of the pages.
    - The teacher will write the main points from this sharing activity on the whiteboard.

Activity 2 (25 minutes)

- Activity/Questions/Instructions
    - Ask students to solve all four pages of Poppi's Puzzles found in the Activity Packet.
    - Students will write their answers in their notebooks OR in the Activity Packet.
- Conclusion/Wrap-up
    - When all groups are done have each group write their answers on the whiteboard.
    - Note: The solutions to Poppi's Puzzles are in the Activity Packet. The teacher should have these handy to correct any student errors.
    - Alternative: Any of these Poppi's Puzzles that are not completed can be assigned for homework.

LESSON 2 40 MINUTES

Intermediate Lesson Plans

Description:
Students will learn more about atomic mass and isotopes. This lesson also includes the Tell Me More...series where students will learn more about Marie Curie, Albert Einstein, the Solvay Conferences, and Quantum Mechanics.

Activity Outcomes:

- Students will read the descriptions on the next two pages.
- Students will complete the table and show their understanding of major and minor isotopes.
- Students will understand the historical significance of File 2: The Case of the Missing (Atomic) Model.

Materials Needed:

1. Each student will need a pencil, eraser, and a notebook.
2. Each student will need access to the Kids' Chemical Solutions Activity Packet for File 2: The Case of the Missing (Atomic) Model.

Set Up for Activities 1 - 4:

1. Each student will need a pencil, eraser, and a notebook.
2. Each student will need access to the Kids' Chemical Solutions Activity Packet for File 2: The Case of the Missing (Atomic) Model.
3. Students can work alone or in groups of 2 - 3.

Activity 1 (10 minutes):
Activity/Questions/Instructions

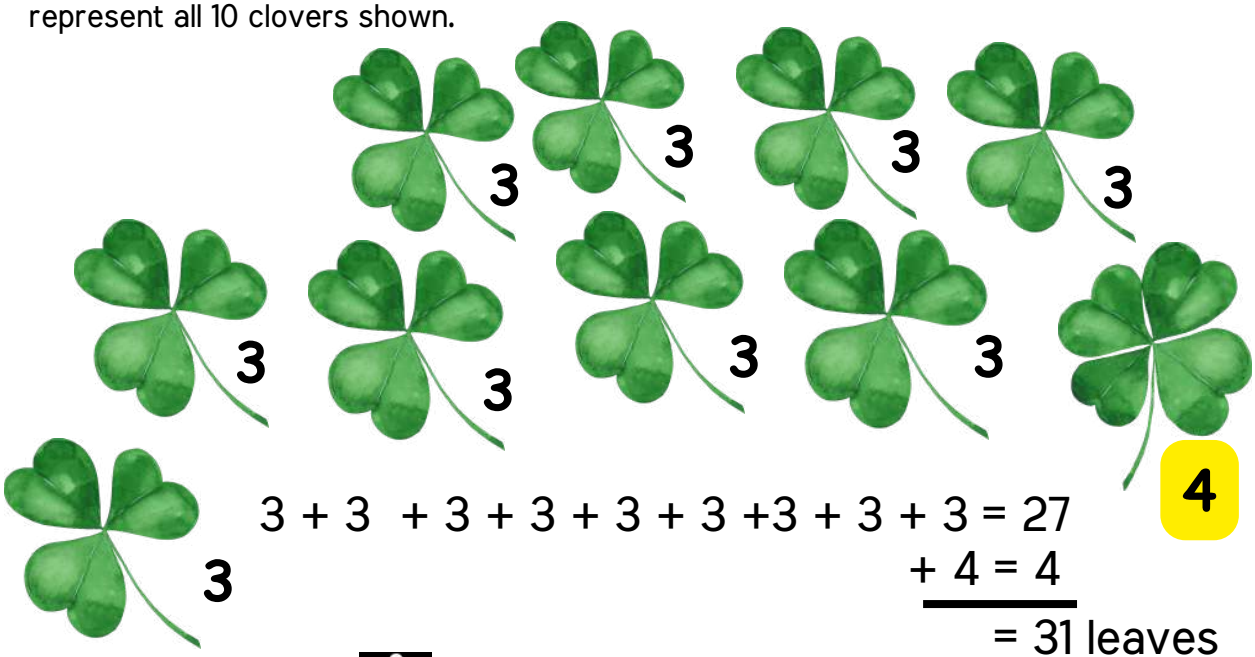
- Ask students to read the next 2 pages.
- The teacher will write the table on the white board and ask students to complete the table in their notebooks.

Conclusion/Wrap-Up

- When all groups are done, the teacher leads a discussion about what this page means and why we use the rounded whole number to represent the atomic mass of an atom of a certain element.
- The teacher will also have students complete the table on the whiteboard. [Answers are provided in red.]

Atomic masses have decimal points because they represent all the forms of an element. Consider the example below. All 10 are clovers and could be considered the same "element". Nine of the clovers have 3 leaves, and are the majority. One of them has 4 leaves, and is a minority. The 4-leaf clover is a natural variant.

If we calculate the average number of leaves on the clovers shown below, it comes out to 3.1. BUT does any one clover have 3.1 leaves??? NO! The number 3.1 is an average to represent all 10 clovers shown.



3 + 3 + 3 + 3 + 3 + 3 +3 + 3 + 3 = 27

+ 4 = 4

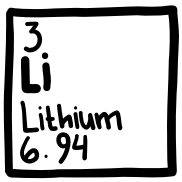
= 31 leaves

31 ÷ 10 clovers = 3.1 (average)

The same can be true of elements. Some elements, like clovers, naturally have an "odd man out" that has either one less or one more neutron. An element is defined ONLY by the number of protons it has. So, if it has a different number of neutrons, it's still the same element.

Let's consider lithium.

- The majority form of lithium has 3 protons + 4 neutrons that equals an atomic mass of 7.
- The minority form of lithium has 3 protons and 3 neutrons that equals an atomic mass of 6.
- If we have a pile of 100 lithium atoms:
  - 94 of them have a mass of 7. This is the major form.
  - 6 of them (natural outliers) have a mass of 6. This is the minor form.
  - The average of these comes out to a mass of 6.94. That's what is written on the Periodic Table for lithium.
  - BUT NO LITHIUM ATOM HAS AN ATOMIC MASS OF 6.94; INSTEAD THE MAJORITY OF LITIUM ATOMS HAS A MASS OF 7.
  - That's why we use the rounded whole number of 7 as the atomic mass for lithium.



Chemists use the term "isotope" to refer to the two different forms of an element - the major and the minor. In the example for lithium, the major isotope of lithium has an atomic mass of 7 and the minor isotope of lithium has an atomic mass of 6.

The term isotope means that the atoms have the same number of protons, a different number of neutrons, and a different atomic mass.

Fill in the blanks below. The first two are done as an example.

	protons	atomic mass of major isotope	atomic mass of minor isotope
19 K Potassium 39.098	19	39	40
5 B Boron 10.806	5	11	10
8 O Oxygen 15.999			
15 P Phosphorus 30.974			
9 F Fluorine 18.998			
53 I Iodine 126.90			
24 Cr Chromium 51.996			
20 Ca Calcium 40.078			

Chemists use the term "isotope" to refer to the two different forms of an element - the major and the minor. In the example for lithium, the major isotope of lithium has an atomic mass of 7 and the minor isotope of lithium has an atomic mass of 6.

The term isotope means that the atoms have the same number of protons, a different number of neutrons, and a different atomic mass.

Answer Key

Fill in the blanks below. The first two are done as an example.

	protons	atomic mass of major isotope	atomic mass of minor isotope
19 K Potassium 39.098	19	39	40
5 B Boron 10.806	5	11	10
8 O Oxygen 15.999	8	16	15
15 P Phosphorus 30.974	15	31	30
9 F Fluorine 18.998	9	19	18
53 I Iodine 126.90	53	127	126
24 Cr Chromium 51.996	24	52	51
20 Ca Calcium 40.078	20	40	41

Activity 2 (10 minutes):
Activity/Questions/Instructions

- Ask students to read Tell Me More...about the friendship between Albert Einstein and Marie Curie.
- Ask students to respond to the questions in their notebooks:
  - When did Albert Einstein and Marie Curie first meet? How old were they?
  - Describe how Albert Einstein came to Marie Curie's defense.
  - Where did many of Albert and Marie's conversations take place?

Conclusion/Wrap-Up

- When all groups are done, the teacher leads a discussion about these questions.
- Alternative: The teacher can assign vocabulary words.

Activity 3 (10 minutes):
Activity/Questions/Instructions

- Ask students to read Tell Me More...about the Solvay Conferences.
- Ask students to respond to the questions in their notebooks:
  - Who attended the 1927 Solvay Conference?
  - Describe what was debated at this conference.

Conclusion/Wrap-Up

- When all groups are done, the teacher leads a discussion about these questions.
- Alternative: The teacher can assign vocabulary words.

Activity 4 (10 minutes):
Activity/Questions/Instructions

- Have each student look up these scientists and write a 1-sentence summary of what he discovered.
  - Albert Einstein
  - Max Planck
  - Neils Bohr
  - Louis De Broglie
  - Werner Heisenberg
  - Erwin Schroedinger

Conclusion/Wrap-Up

- Discuss each person.
- Alternative: This could be done for homework.

LESSON 3 40 MINUTES

Intermediate Lesson Plans

Description:
Students begin reading File 2 The Case of the Missing (Atomic) Model in this lesson. Students will also be completing the associated Reading Guide.

Activity Outcomes:

- Students will be complete the Reading Guide associated with pages 1 - 9 of File 2.
- Students will share their ideas about the story from pages 1 - 9 of File 2.

Materials Needed:

1. Each student will need a pencil, eraser, and a notebook.
2. Each student will need access to File 2: The Case of the Missing (Atomic) Model, pages 1 - 9.
3. Each student will need access to the Kids' Chemical Solutions Activity Packet for File 2: The Case of the Missing (Atomic) Model, the Reading Guide pages.

Set Up for Activities 1 & 2:

1. Each student will need a pencil, eraser, and a notebook.
2. Each student will need access to File 2: The Case of the Missing (Atomic) Model .
3. Each student will need access to the Kids' Chemical Solutions Activity Packet for File 2: The Case of the Missing (Atomic) Model, the Reading Guide pages.
4. Students can work alone or in pairs.
5. Alternatives: Students can read aloud to each other by choosing a character in the comic book.

Activity 1 (20 minutes):

Activity/Questions/Instructions

- Ask students to read pages 1 - 4 in File 2.
- Ask students to respond to the questions in the Reading Guide for pages 1 - 4. This should include writing down any vocabulary words that need to be understood.
- Students can write their responses and vocabulary words in their notebooks OR on the printed Reading Guides.

Conclusion/Wrap-Up

- When all groups are done, the teacher leads a discussion about what is happening on pages 1 - 4 and discusses responses to the Reading Guide questions.
- Alternative: The teacher can assign vocabulary words.

Activity 2 (20 minutes):

Activity/Questions/Instructions

- Ask students to read pages 5 - 9 in File 2.
- Ask students to respond to the questions in the Reading Guide for pages 5 - 9. This should include writing down any vocabulary words that need to be understood.
- Students can write their responses and vocabulary words in their notebooks OR on the printed Reading Guides.

Conclusion/Wrap-Up

- When all groups are done, the teacher leads a discussion about what is happening on pages 5 - 9 and discusses responses to the Reading Guide questions.
- Alternative: The teacher can assign vocabulary words.