INVESTIGATION 4

CAN YOU SEE RADIATION?

INTRODUCTION

When radiation passes through a substance, it often causes ionizations. This is because the radiation knocks electrons off some of the atoms in the material through which it passes. These ionizations are visible as streaks, or vapor trails, in an apparatus called a cloud chamber. **In this exercise, you will build a cloud chamber and use it to see the effect of the radiation emitted by a radioactive material.**

OBJECTIVES

To build a cloud chamber and use it to detect radiation.

MATERIALS

Sample of radioactive ore (e.g., uranium), or a radioactive pin from a science education supply house

- Large piece of dry ice
- Thick cloth (e.g. towel)
- Light source
- Thick, absorbent paper (e.g., blotter paper)
- Black felt or black construction paper
- Large clear jar (e.g., peanut butter jar or mayonnaise jar). Use a jar that is short and squat; that will give better results.
- Alcohol (e.g., rubbing alcohol)
- Glue
- Tongs or gloves

PROCEDURE

1. Set up your cloud chamber apparatus, as illustrated in Figure 1.

2. Put a piece of black felt or paper into the jar lid, cut to fit, and glue in place. This provides a dark background for viewing the ionizations.

3. Attach piece of thick (blotter) paper to bottom of jar, using hot glue or a wire spring to hold it in place.

4. Saturate the absorbent blotter paper with alcohol, the vapor of which will form the “cloud”.

5. Run hot water over the outside of the jar to warm it.

6. Put a large piece of dry ice on a cardboard or wooden surface, and wrap it in a piece of thick cloth (e.g., towel). Leave a hole or space in the center of the cloth to allow the lid of the jar to come into direct contact with the dry ice. [**Caution: Do not touch or handle dry ice or radioactive sources with your bare hands. Use tongs or gloves. Methyl alcohol is poisonous and flammable. Keep it away from flames.**]

7. Put the lid on the jar and invert the jar on top of the dry ice, making sure that the jar lid is in direct contact with the dry ice. The object is to make the jar lid as cold as possible.

8. Shine the light source, angled slightly downward, through the cloud chamber.

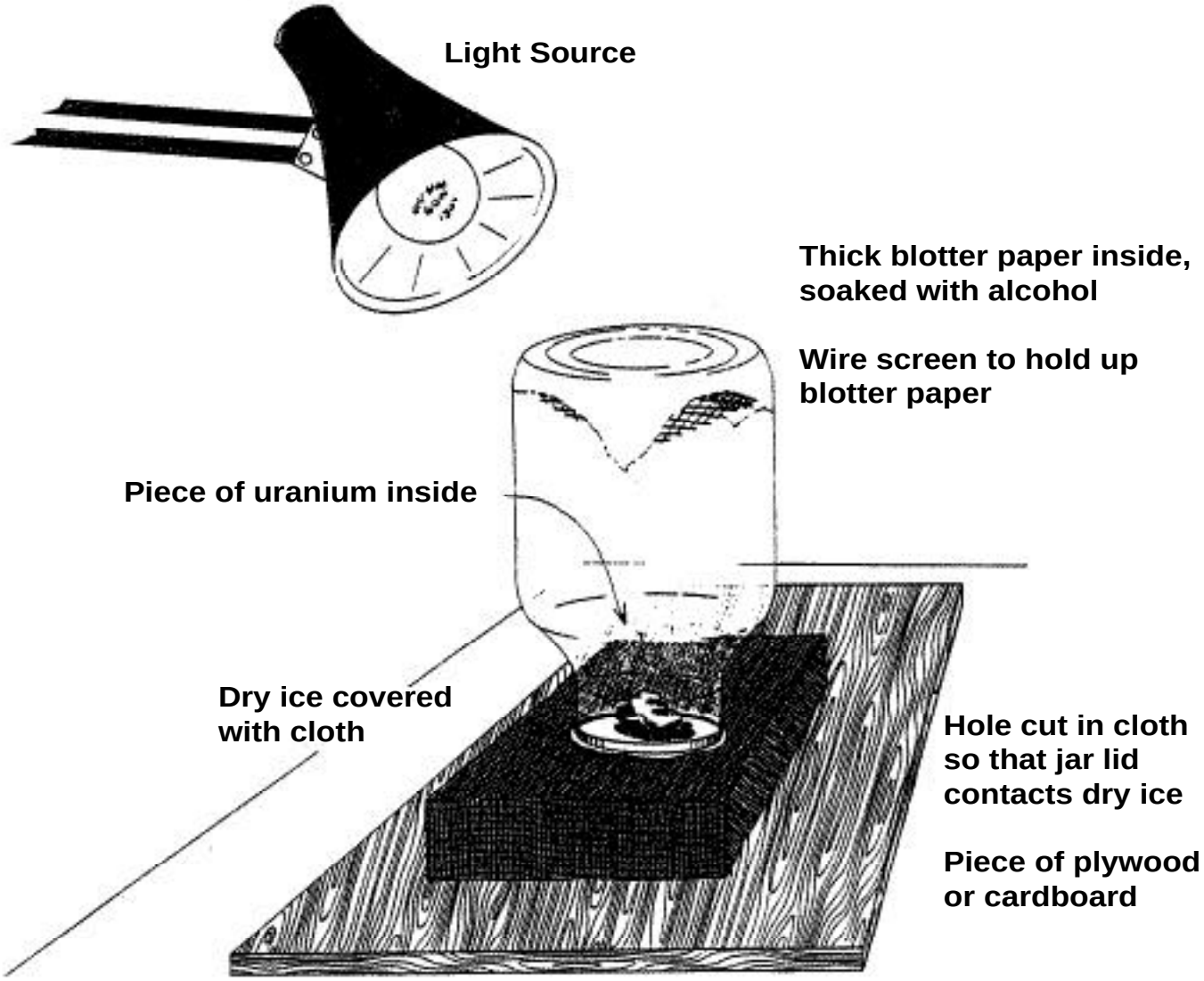

Figure 1. Diagram of cloud chamber apparatus.

OBSERVATIONS

9. Wait about 10 minutes for the jar to cool and observe the vapor trails against the dark felt background. Draw a diagram of the streaks observed during a five minute period.

10. Open the jar lid and quickly place the radioactive source on the lid. Replace the lid and return the jar to the dry ice.

11. Draw a diagram of the streaks observed during a five minute period with the radioactive material present in the jar.

ANALYSIS

12. Depending on what kind of radioactive source you use, you may observe either one or two different kinds of streaks. Some may be heavy streaks that go in a straight line.Some may be lighter streaks that tend to be more erratic. Describe what you see and explain what is taking place.

13. Record the number of streaks observed during a two minute period and classify them as alpha or beta. What is the ratio of alpha to beta emissions that you observe?

CONCLUSIONS

14. Are you seeing all of the radioactive disintegrations? Why or why not?

15. How does this experiment relate to the harmful effects of radon gas in the home?

NOTES