Introduction to sodium technology –
Neutronic characteristics of sodium and complexities

K.S. Rajan
Professor, School of Chemical & Biotechnology
SASTRA University
Table of Contents

1 QUIZ..........................................................................................................................3
  1.1 QUESTIONS........................................................................................................... 3
  1.2 ANSWERS ............................................................................................................. 3
1 Quiz

1.1 Questions

1. What are the isotopes formed due to neutron irradiation of sodium?

2. Which of the following is formed due to sodium-air reaction at the lowest oxygen availability?
   (a) NaO  (b) Na₂O  (c) Na₂O₂  (d) NaO₂

3. Which of the following is formed due to sodium-air reaction at higher oxygen (partial) pressures?
   (a) NaO  (b) Na₂O  (c) Na₂O₂  (d) NaO₂

4. Determine the quantity of heat released when 1 g of sodium reacts with water. The heat of reaction is -162 kJ/mole.

5. Which among the two reactions is faster than the other one?
   (a) sodium-water reaction (b) sodium-air reaction

6. Name of the final products of sodium-water reaction.

7. Why is the detection of hydrogen’s presence in sodium is considered essential?

8. What is the function of economizer in cold trap?

9. Why is the heat exchanger in cold trap called ‘economizer’?

1.2 Answers

1. Na-24 and Na-22

2. (b) Na₂O

3. (d) NaO₂

4. 1 g of sodium corresponds to (1/23) mole. Therefore energy released when 1 g of sodium reacts with water is 162/23 kJ/g (~ 7 kJ/g).

5. (a) sodium-water reaction

6. Na₂O and NaH
7. Hydrogen is the by-product of the first stage of reaction between water and sodium. Hence hydrogen detection is used to detect the leakage of water into sodium, to prevent escalation of large scale, exothermic reaction between sodium and water.

8. It is used to cool impurities-laden sodium for separation of impurities like Na₂O and NaH.

9. Sodium, after removal of Na₂O and NaH is heated by thermal contact with incoming impurities-laden sodium thereby utilizing its heat content and partially cooling the same. This reduces the requirement of utilities for the cold trap.