

# SOLUTIONS TO CHAPTER 5

## PROBLEMS 37 AEROSTUDENTS

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#### Solutions to Chapter 5 Problems

##### Problem 37: Aerostudents

**Question:** A group of aerostudents is designing a hot-air balloon that will carry a total load of 500 kg. The balloon will be filled with air heated to a temperature of 100 °C. The atmospheric pressure is 101 kPa, and the temperature of the air outside the balloon is 20 °C.

a) What volume must the balloon have to lift the load? b) What is the density of the air inside the balloon?

##### **Answer:**

a) To determine the volume of the balloon, we can use the following equation:

$$\text{Volume} = (\text{Load} / (\text{Density of air inside} - \text{Density of air outside}))$$

The density of air at 100 °C can be calculated using the ideal gas law:

$$\text{Density} = (\text{Pressure} / (\text{Temperature} * \text{Gas constant}))$$

Inserting the values given in the problem, we get:

$$\text{Density of air inside} = (101 \text{ kPa} / ((100 + 273) \text{ K} * 287 \text{ J/kg-K})) = 0.948$$

The density of air at 20 °C is:

$$\text{Density of air outside} = (101 \text{ kPa} / ((20 + 273) \text{ K} * 287 \text{ J/kg-K})) = 1.205$$

Substituting these values into the equation for volume, we get:

$$\text{Volume} = (500 \text{ kg} / (0.948 \text{ kg/m}^3 - 1.205 \text{ kg/m}^3)) = 1673 \text{ m}^3$$

Therefore, the balloon must have a volume of 1673 m<sup>3</sup> to lift the load.

b) The density of the air inside the balloon is 0.948 kg/m<sup>3</sup>.

### **Win with the Stonewall Dutch Defense**

The Stonewall Dutch Defense is a solid and reliable opening for Black against 1.d4. It features a quick fianchetto of the king's bishop and the early occupation of the central squares e5 and d6. This article explores some common questions and answers about playing the Stonewall Dutch to help you achieve success with this opening.

**Q: What are the key ideas behind the Stonewall Dutch Defense?** A: The Stonewall Dutch is designed to deny White the control of the center with pawns and instead fight for it with pieces. By fianchettoing the king's bishop and controlling the e5 and d6 squares, Black aims to create a strong pawn structure and active piece play.

**Q: How should Black respond to White's early pawn advances?** A: In most variations of the Stonewall Dutch, Black will typically meet White's early pawn pushes with ...f5, ...Nf6, and ...e6. These moves help solidify Black's position in the center and prepare for the fianchetto of the bishop.

**Q: What are some of the typical lines in the Stonewall Dutch?** A: One of the main lines in the Stonewall Dutch is the line 1.d4 f5 2.c4 Nf6 3.g3 e6 4.Bg2 Bb4+. This position often leads to a tactical battle for the center with both sides vying for the initiative. Another common line is the Leningrad variation, which occurs after 1.d4 f5 2.c4 e6 3.Nf3 g6 4.Bg5 Nf6. This variation is known for its complex strategic play.

**Q: What are some of the challenges facing Black in the Stonewall Dutch?** A: One of the main challenges for Black in the Stonewall Dutch is the lack of space on the kingside. The early fianchetto of the king's bishop can restrict Black's piece activity on that side of the board. Additionally, White often has the initiative in the center, which can make it difficult for Black to generate counterplay.

**Q: What are some tips for Black to win with the Stonewall Dutch Defense? A:**

To increase your chances of victory with the Stonewall Dutch, focus on controlling the center with pieces, developing your pieces quickly, and taking advantage of any tactical opportunities. Be patient and wait for the right moment to launch an attack. Study the common lines and typical plans to improve your understanding of the opening.

**Year 9 Science Workbook with Answers: A Comprehensive Guide for Key Stage 3**

The "Year 9 Science Workbook with Answers" by Lonsdale Educational Experts is an essential resource for students preparing for the Key Stage 3 National Curriculum in Science. This workbook provides a comprehensive and structured approach to Science, covering all the core topics with detailed explanations and engaging activities.

**1. Key Features of the Workbook:**

The workbook includes:

- Concise and clear explanations of scientific concepts
- Step-by-step guidance on practical investigations
- Practice questions and activities to reinforce learning
- Comprehensive answers for all questions in the workbook
- Additional support and resources online

**2. Addressing Core Science Topics:**

The workbook covers all the core Science topics for Year 9, including:

- Biology: Ecosystems, Cells, and Energy Transfer
- Chemistry: Chemical Reactions, Elements, and Acids and Bases
- Physics: Forces, Energy, and Electricity

**3. Practical Investigations and Experiments:**

The workbook includes a range of practical investigations and experiments that allow students to apply their knowledge and develop their scientific skills. These activities cover topics such as:

- Investigating the effect of light intensity on photosynthesis
- Measuring the pH of different substances
- Designing and testing a simple battery

#### 4. Sample Question and Answer:

**Question:** What is the difference between an exothermic and an endothermic reaction?

**Answer:**

- **Exothermic reactions** release energy to the surroundings, making the temperature of the surroundings increase.
- **Endothermic reactions** absorb energy from the surroundings, making the temperature of the surroundings decrease.

#### 5. Assessment and Support:

The workbook provides comprehensive answers for all questions, allowing students to self-assess their understanding and identify areas for improvement. The additional online support includes resources such as practice exams and videos, further enhancing students' preparation for Science assessments.

### Saudi Arabian Monetary Authority (SAMA): A Comprehensive Q&A

#### 1. What is SAMA?

SAMA is the central bank of Saudi Arabia, responsible for regulating and supervising the country's financial system. It was established in 1952 and has the authority to issue currency, manage foreign exchange reserves, and set monetary policy.

#### 2. What are SAMA's primary functions?

SAMA's primary functions include: \_\_\_\_\_

- Issuing and regulating the Saudi riyal
- Managing the country's foreign exchange reserves
- Controlling inflation and promoting economic stability
- Regulating and supervising banks and other financial institutions
- Providing financial stability and protecting depositors' rights

### **3. How does SAMA stabilize the Saudi economy?**

SAMA stabilizes the Saudi economy through various monetary policy tools, such as:

- Setting interest rates and reserve requirements
- Controlling money supply and liquidity
- Managing government finances
- Intervening in foreign exchange markets

### **4. What are SAMA's regulatory responsibilities?**

SAMA has extensive regulatory responsibilities to ensure the safety and soundness of the financial system. These responsibilities include:

- Licensing and regulating banks, financial institutions, and insurance companies
- Setting regulations for financial transactions and products
- Monitoring and enforcing financial regulations
- Protecting consumers against financial fraud

### **5. How is SAMA's role different from other central banks?**

While SAMA shares many common duties with other central banks, it also has some unique responsibilities due to Saudi Arabia's status as a major oil exporter. These responsibilities include:

- Managing the flow of petrodollars into and out of the country
- Supporting the government's fiscal policies
- Investing excess oil revenues in sovereign wealth funds

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