CHEMICAL PROBLEMS.

1. How much potassium chlorate is needed to furnish 1 lb. of oxygen? *Ans.* 2.554 lbs.

2. On completely decomposing by heat a certain weight of potassium chlorate, I obtain 20.246 grams of potassium chloride. What weight of potassium chlorate did I take, and how much oxygen was evolved?

Ans. 33.27 grams; 13.03 grams.

3. How much oxygen can be obtained by the decomposition of 100 grams of mercury monoxide? *Ans.* 7.4 grams.

4. Required the weight of ammonia and of chlorine needed to produce a litre of nitrogen?

Ans. 6.08 grams ammonia gas; 9.52 grams chlorine.

5. What weight of copper is required to yield a litre of nitrogen dioxide at 0°C and 760mm.?

Ans. 4.224 grams.

6. What volume of oxygen at 0° and 760mm. can be theoretically obtained from 1 lb. of bleaching powder, $Ca\,Cl_2.Ca\,Cl_2\,O_2+2H_2O$?

Ans. 34.67 litres.

7. How many litres of oxygen are contained in 3 litres of nitrogen tetroxide? *Ans.* 3 litres.

8. Deduce the formulæ of the following substances:

(*a*)		(*b*)	
Potassium,	28.73	Carbon,	19.04
Hydrogen,	0.73	Hydrogen,	4.76
Sulphur,	23.52	Sulphur,	25.40
Oxygen,	47.02	Oxygen,	50.80
	100.00		100.00

Ans. (*a*) $KHSO_4$. (*b*) $C_2H_6SO_4$.

9. 1.5035 grams of a mixture of sodium and potassium chloride gave 3.4222 grams of silver chloride. Calculate the relative amounts of the two chlorides. *Ans.* Na Cl 66.3; KCl 33.7.

10. What weight of water would be heated from 0° to 1° C. by the combustion of 1 gram of hydrogen? *Ans.* 34.46 kilos.

THEORY OF HEAT.

QUESTIONS AND EXERCISES.

1. If 6 lbs. of water at 35° C. be mixed with 5 lbs. of water at 67° C, find the temperature of the mixture. *Ans.* $49\frac{4}{11}$°.

2. A glass rod is 8 feet 6 inches long, at 20° C; find its length at 45° C. *Ans.* 8.502 ft.

3. How many pounds of steam at 100° C. will just melt 12 lbs. of ice at 0° C.? *Ans.* $1\frac{1}{15}$ lbs.

4. Explain the effect of blowing a fire. How is it that you may sometimes increase the heat of a fire by blowing it, and sometimes blow out?

5. Explain clearly what is meant by the phrase "the latent heat of ice is 79°."

6. Why does hot water cool more rapidly in a shallow dish than in a deep one of the same capacity?

7. If a vessel containing ice be brought into a warm room, its sides usually run down with water. Explain the reason of this.

8. If 5 lbs. of ice at 32° F. be added to 1 lb. of steam at 212° F., what is the resulting temperature? *Ans.* 104.3° F.

9. When the day is warm you cannot see your own breath; when cold you can. State the reason.

10. If a certain weight of gas measures 6,000 cubic feet when the barometer is at 30 inches, how much will it measure when the barometer is at 28 inches? *Ans.* 6,728$\frac{4}{7}$ cub. ft.

EXERCISES IN GEOMETRY.

ANGLES AND TRIANGLES.

1. An angle is equal to 12° 12′ 13″. Find an angle four times as large.

2. What angles do the hands of a clock make at 8 o'clock?

3. What angle is described by the minute hand of a clock in forty minutes?

4. What angle is described by the hour hand in 5 hours?

5. Find the value of two adjacent supplementary angles, if one is 14 times as large as the other.

6. Find the supplement of 35° and the complement of 84°.

7. What is the supplement of the complement of 42°?

8. What is the complement of the supplement of 91°?

9. Through the vertex of a right angle a line is drawn outside the angle. What is the sum of the two acute angles thereby formed?

10 One acute angle of a right triangle is 24° 32′. Find the other acute angle.

11. Of the angles of a triangle the second is twice the first, and the third three times the second. Find all the angles.

12. If three angles of a quadrilateral are right angles, what is the value of the fourth angle?

13. Make a quadrilateral having the greatest possible number of obtuse angles.