5. Describe in detail an experiment to illustrate the law of definite proportions.

6. Three glass cylinders covered with glass plates and said to contain hydrogen sulphide, nitric oxide and carbonic oxide, are set before you. How would you proceed to distinguish the gases?

7. What weight of sulphur will it be necessary to burn in order to produce sufficient gas to neutralize 10 grammes of sodic hydrate, and what substance results? (At. wt. of sodium = 23.)

8. Two litres of acetylene gas are burned in a room. What will be the volume of gas produced, taken at the temperature of the room?

FORM IV.

1. The changes involved when two substances react on each other may vary according to conditions. Give two examples.

2. Explain how sodium carbonate may be made from sodium chloride.

3. Oxide of aluminium has both acid and basic properties. Explain this statement, using examples.

4. Give an account of the halogen elements, showing in what respects bromine is intermediate in its chemical properties between chlorine and iodine.

5. State and explain what occurs when :—

(*a*) Sulphuric acid is added to potassic bromide and the mixture gently heated.

(*b*) A solution of ferrous sulphate is added to a mixture of dilute sulphuric acid and permanganate of potash.

(*c*) Hydric sulphide gas is passed into a ferric solution, acidified with hydrochloric acid.

6. When .5 grammes of a certain metal are dissolved in dilute sulphuric acid 465 c.c. of hydrogen at 0°C. and 760 m.m. barometric pressure are liberated. A determination of its specific heat gives .24. Find the atomic weight of the metal

7. Determine the base and acid in the salt submitted.

## ALGEBRA.—FORM III.

(Continued from page 355 1899.)

5. Reduce to its simplest form $\left\{-\frac{1}{2}\sqrt[3]{a}+\sqrt{-\frac{3}{4}\sqrt[3]{a^2}}\right\}^3$

Write it $-\frac{1}{2}a^{\frac{1}{3}}+\left(-\frac{3}{4}a^{\frac{2}{3}}\right)^{\frac{1}{2}}$ and cube, and we get

$$-\tfrac{1}{8}a+\tfrac{3}{4}a^{\frac{2}{3}}\left(-\tfrac{3}{4}a^{\frac{2}{3}}\right)^{\frac{1}{2}}-\tfrac{3}{2}a^{\frac{1}{3}}\left(-\tfrac{3}{4}a^{\frac{2}{3}}\right)-\tfrac{3}{4}a^{\frac{2}{3}}\left(-\tfrac{3}{4}a^{\frac{2}{3}}\right)^{\frac{1}{2}}$$

Which is $= -\frac{1}{8}a+\frac{9}{8}a=a$.

6. Find x and y in

(1) $x^2+5xy=14$, and $y^2+6xy=13$.

As the equations are homogeneous in the variable parts, a good solution is to put $y=vx$, and divide one equation by the other.

This gives $\frac{1+5v}{v^2+6v}=\frac{14}{13}$.

Whence we find $v=\frac{1}{2}$ or $-\frac{13}{7}$.

Then from the first $x^2=\frac{14}{1+5v}=4$ or $-\frac{49}{29}$

$\therefore x=\pm 2$, and $\pm\sqrt{-\frac{49}{29}}$.

and thence $y=vx=\pm 1$ and $\pm\sqrt{-\frac{196}{29}}$.

And the corresponding values of x and y are—

$x=+2, -2+\sqrt{-\frac{49}{29}}-\sqrt{-\frac{49}{29}}$

$y=+1, -1-\sqrt{-\frac{196}{29}}+\sqrt{-\frac{196}{29}}$.