

NITROGEN GOES INTO BOTH FERTILIZERS AND EXPLOSIVES.



DRY AMMONIA GAS IS USED IN THE LARGE-SCALE PRODUCTION OF ICE.

**NITROGEN**  
Element 7.  
At. wt. 14.008.  
Colorless, odorless gas. Does not burn. Does not support combustion (burning). .967 weight of air. Slightly soluble in water—1.5 volumes in 100 vols. at 20°C.

the standard headings sections

Cover the following exercises

1. Producing ammonia gas ( $\text{NH}_3$ ) from household ammonia
2. The White Mystery Smoke (ammonium chloride)
3. The Ammonia Fountain
4. Making nitrogen dioxide ( $\text{NO}_2$ ) brown gas from nitric acid and copper

## Nitrogen and Its Compounds

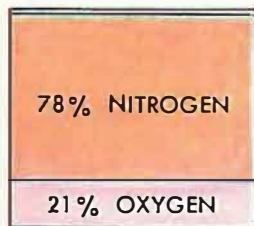
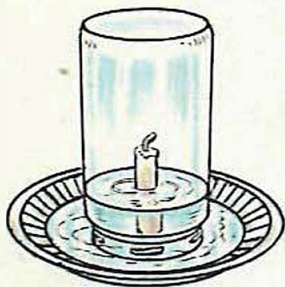
WHEN YOU burn anything in the air, only about one-fifth of the air goes into chemical combination with what you are burning. The rest (except for a small fraction) does not enter into the process. It is a gas called nitrogen (N) — the most abundant free element on earth.

Nitrogen is what you might call a “lazy” element. It does not help in burning nor does it burn if you try to ignite it. It is only at high temperatures and under great pressures that a chemist can make nitrogen combine with another element, hydrogen, to form ammonia gas ( $\text{NH}_3$ ), from which other nitrogen compounds can be made.

Yet, in nature, tiny bacteria on the roots of certain plants can take nitrogen from the air and make it combine with oxygen and minerals in the soil into “nitrates.” And that is of tremendous importance to all of us — for all plants need nitrates if they are to thrive. If plants do not get nitrates naturally, the farmer must add them to his soil in the form of some kind of fertilizer.

You will not have much satisfaction out of working with nitrogen itself, but you will find it interesting to deal with some of its compounds — especially with ammonia gas ( $\text{NH}_3$ ). You will also want to have a look at one of the half dozen combinations nitrogen makes with oxygen, the brown gas called nitrogen dioxide ( $\text{NO}_2$ ).

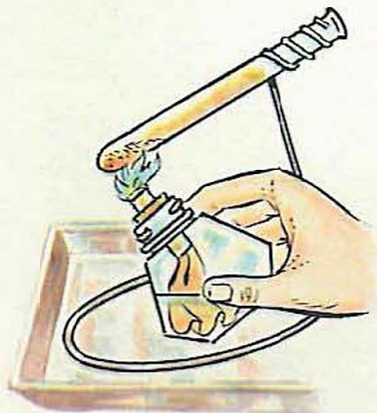
### NITROGEN FROM THE ATMOSPHERE



1% RARE GASES:\*

\* ARGON  
NEON  
KRYPTON  
XENON  
HELIUM  
ALSO:  $\text{CO}_2$ ,  $\text{H}_2\text{O}$

REPEAT CANDLE-BURNING EXPERIMENT ON PAGE 27. UNUSED GAS IS ALMOST ALL NITROGEN—WITH SMALL PERCENTAGE OF RARE GASES AND CARBON DIOXIDE.



**NITROGEN DIOXIDE**  
IN A WELL-VENTILATED ROOM, HEAT EQUAL AMOUNTS OF SALTPETER AND SODIUM BISULFATE IN DRY TEST TUBE. IN A MOMENT, A BROWN GAS FORMS. IT IS NITROGEN DIOXIDE. **DO NOT INHALE**—GAS IS VERY IRRITATING.



**NH<sub>3</sub> AMMONIA**  
 Compound.  
 Molecular weight 17. Colorless gas with strong, penetrating odor. .596 weight of air. Highly soluble in water—70,000 vols. in 100 vols. at 20°C.

### PRODUCING AMMONIA

SIMPLEST WAY OF PRODUCING AMMONIA IS TO GET IT FROM ITS SOLUTION AS HOUSEHOLD AMMONIA.

FILL PINT CAN ONE QUARTER FULL OF HOUSEHOLD AMMONIA. FIT STOPPER WITH 6" GLASS TUBE IN OPENING. PLACE TEST TUBE OVER GLASS TUBE. HEAT CAN OVER LOW FLAME. TEST TUBE IS FULL OF AMMONIA WHEN MOIST, RED LITMUS PAPER HELD AT ITS MOUTH TURNS BLUE.

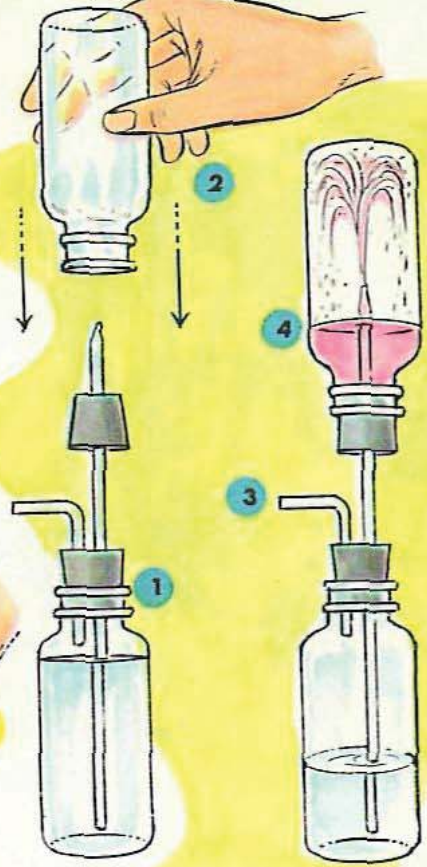
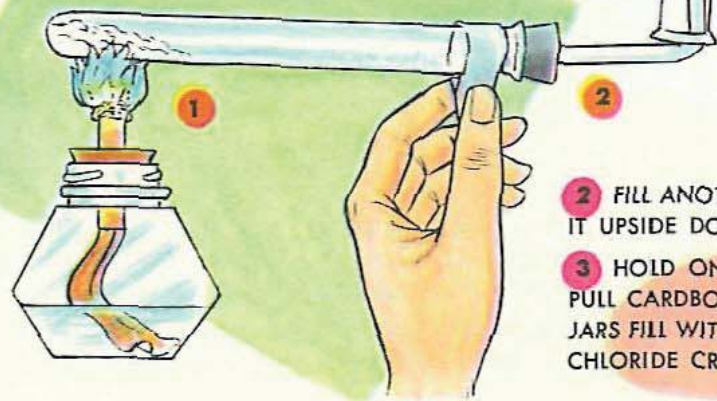
### SOLUBILITY OF AMMONIA

REMOVE A FILLED TEST TUBE FROM GAS GENERATOR CAN, MOUTH DOWN. CLOSE MOUTH OF TUBE WITH THUMB. OPEN TUBE UNDER WATER. AMMONIA DISSOLVES EASILY, WATER RUSHES IN AND FILLS TUBE.

MOIST, RED LITMUS PAPER TURNS BLUE IN AMMONIA.

### MAKING AMMONIA FROM SAL AMMONIAC

- ON A PIECE OF PAPER, MIX 1 PART OF SAL AMMONIAC WITH 2 PARTS OF HYDRATED LIME. ADD A FEW DROPS OF WATER. DROP MIXTURE INTO A TEST TUBE. PROVIDE TUBE WITH STOPPER AND L-SHAPED GLASS TUBE. THEN HEAT OVER LOW FLAME.
- COLLECT AMMONIA IN DRY TEST TUBE. TEST IT WITH LITMUS PAPER AND FOR SOLUBILITY.



### THE AMMONIA FOUNTAIN

AMMONIA'S EXTRAORDINARY SOLUBILITY CAN BE SHOWN IN A SPECTACULAR DEMONSTRATION.

- MAKE UP APPARATUS AS SHOWN IN ILLUSTRATION. FILL IT WITH WATER. ADD 5 DROPS OF PHENOLPHTHALEIN SOLUTION.
- FILL DRY, EMPTY BOTTLE WITH AMMONIA FROM GENERATOR CAN. KEEPING BOTTLE UPSIDE DOWN, PLACE IT FIRMLY ON TOP STOPPER OF APPARATUS.
- BLOW INTO L-SHAPED GLASS TUBE TO DRIVE A FEW DROPS OF WATER UP INTO THE UPPER BOTTLE.
- SUDDENLY, WATER SPURTS FROM LOWER BOTTLE UP INTO UPPER BOTTLE IN A FOUNTAIN THAT TURNS PINK AS AMMONIA REACTS ON PHENOLPHTHALEIN.

### THE WHITE SMOKE MYSTERY

- MOISTEN INSIDE OF JAR WITH SMALL AMOUNT OF HYDROCHLORIC ACID. POUR EXCESS ACID BACK INTO ITS BOTTLE. COVER JAR WITH SQUARE OF CARDBOARD.
- FILL ANOTHER JAR WITH AMMONIA. PLACE IT UPSIDE DOWN ON CARDBOARD.
- HOLD ON TO AMMONIA-FILLED JAR AND PULL CARDBOARD AWAY. IMMEDIATELY, BOTH JARS FILL WITH "SMOKE" OF TINY AMMONIUM CHLORIDE CRYSTALS.

