RAPIDOXYGEN™

Emergency oxygen when you need it.™

RED HERRING N. AMERICA FINALIST 100

Awarded May 2019

School Health Customer Webinar

June 10, 2020

What we will cover

- The Gas Laws and Oxygen?
- General Benefits of Oxygen
- Why Emergency Oxygen?
- Why Public Access Oxygen?
- Oxygen Delivery System Types
- Rapid Oxygen's R15 vs Oxygen Cylinders
- How to use the R15
- Q&A

What is OXYGEN?

- Atomic number 8 with the symbol O
- Discovered in 1773 by Carl Wilhelm Scheele (although credit is often given to Joseph Priestly in 1774)
- Air is 21% oxygen and is essential for life, driven by plant photosynthesis
- Oxygen gas is colorless, odorless and tasteless
- Approximately 2/3 of the mass of the human body is oxygen, much of it in the form of water, H_2O
- Oxygen is the most abundant element in Earth's crust (47%)
- A human being uses about 550 liters of pure oxygen per day

Ideal Gas Law

Robert Boyle
(1627 – 1691)

PV = constant

Jacques Charles
(1746 – 1823)

V/T = constant

Joseph Gay-Lussac
(1778 - 1850)

P/T = constant

Amedeo Avogadro
(1776 - 1856)

V/n = constant

$$PV = nRT$$

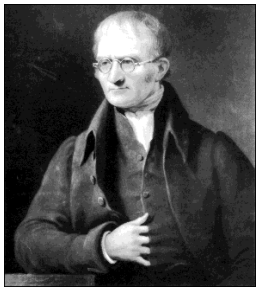
P = Pressure (atmospheres)
V = Volume (liters)
n = Amount (moles)
R = Ideal gas constant (0.0821 L-atm/mol-K)
T = Temperature (K)

Pressure/Volume Relationship

Deep Ocean to Space

The Titanic sunk at a depth of 12,500 feet. The pressure there was 380 times greater than than at sea level, meaning the same amount of gas would take up only 1/380th of the volume

Dalton's Law of Partial Pressure



John Dalton
(1766 – 1844)

In a mixture of non-reacting gases, the total pressure exerted is equal to the sum of the pressures of the individual gases.

Sum of Partial Pressures = 100%

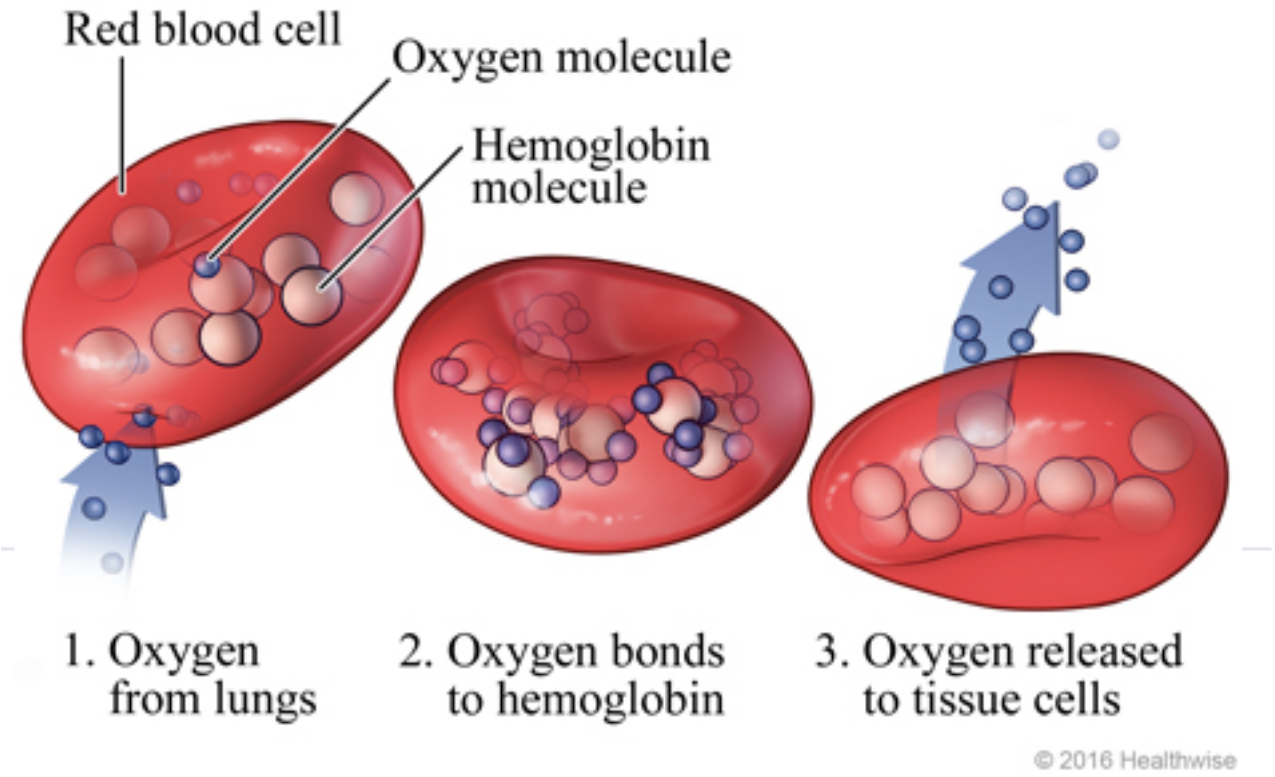
Ambient Air: 78% Nitrogen, 21% Oxygen, 1% Other

VS

100% Oxygen

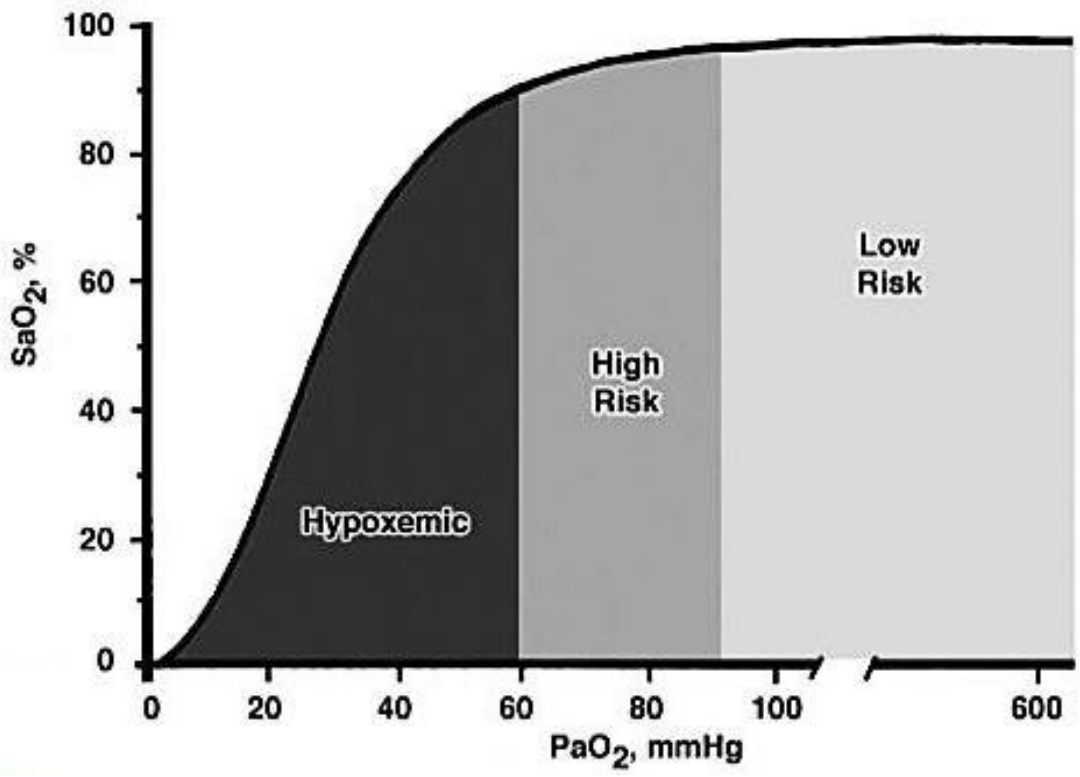
Oxygen Cascade

Route 66: Chicago to LA



Oxyhemoglobin Dissociation Curve

An important tool for how our blood carries and releases oxygen



O_2 Sat. = O_2 content/O_2 capacity

O_2 content. = [Hg] X 1.39 ml O_2/g

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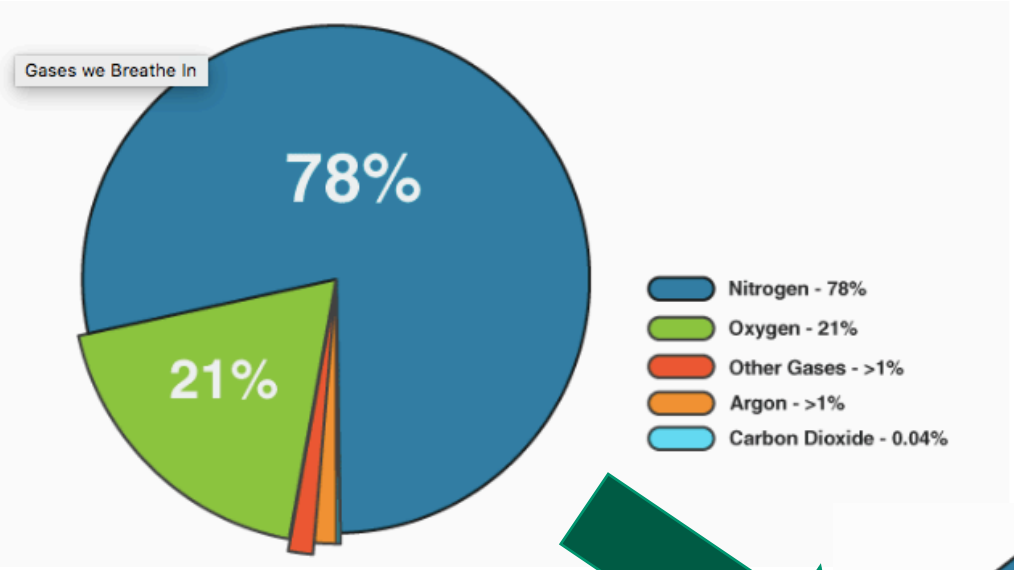
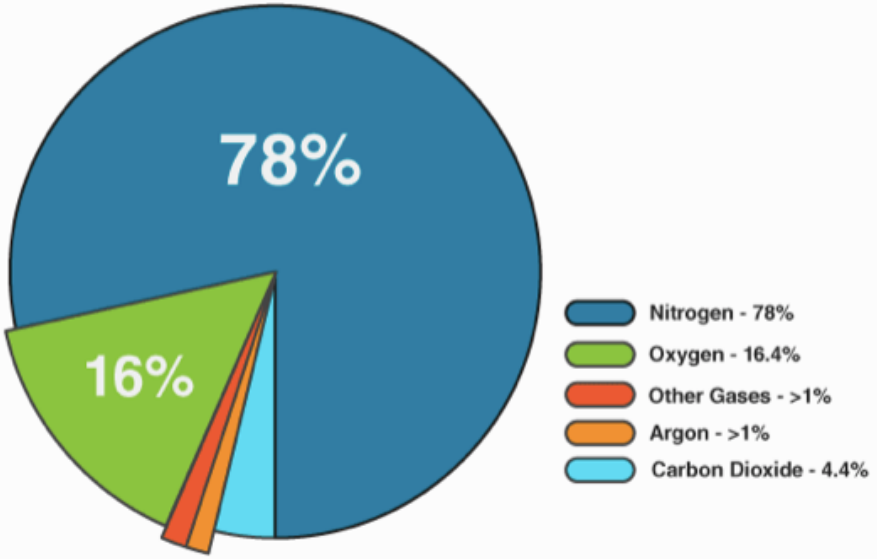
Inspiration vs Expiration





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Partial Pressure Oxygen Cascade

				PRESSURE (mm Hg)								
		% Oxygen		Oxygen		CO2		H20		Nitrogen		Tot
		Air	R15	Air	R15	Air	R15	Air	R15	Air	R15	760
Air	Insp	21	35	150	250	0	0	25	47	585	463	760
	Exp	17	35	120	200	25	0	47	47	568	513	760
Lung	Insp	21	35	100	250	30	30	47	47	583	433	760
	Exp	17	31	50	150	45	45	47	47	618	518	760
Blood	Art	94+	100	80+	90	40	40	47	47	593	583	760
	Vein	75	75	35	40	45	45	47	47	633	628	760
Tissues		1	1	7	15	45	45	47	47	661	653	760
Mito		0.1	0.1	0.5	2	45	45	47	47	667	666	760
Aerobic	ATP	28	28	28	28	28	28	28	28	28	28	

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General Benefits of Oxygen

- Creates energy
- Helps digest food
- Eliminates toxins from the body
- Fuels the body muscles
- Metabolizes fat and carbohydrates
- Removes viruses, parasites and harmful bacteria
- Strengthens immune system
- Helps manufacture of hormones and proteins
- Keeps the heart pumping
- Incites the lungs to breathe
- Allows the nervous system to function normally

WHY Emergency OXYGEN?

- "Emergency oxygen can be given for many breathing and cardiac emergencies. It can help improve hypoxia* (insufficient oxygen reaching the cells) and reduce pain and breathing discomfort. Consider administering emergency oxygen for:
    - An adult breathing fewer than 12 or more than 20 breaths per minute
    - A child breathing fewer than 15 or more than 30 breaths per minute
    - An infant breathing fewer than 25 or more than 50 breaths per minute
    - A person who is not breathing"

-- American Red Cross

* Signs and symptoms of hypoxia include: increased breathing and heart rate, changes in levels of consciousness, restlessness, cyanosis (bluish color on lips and nailbeds, and chest pain

WHY Emergency OXYGEN?

Recommending authorities

- "Serious and life-threatening medical emergencies often cause oxygen to be depleted in the body leaving the victim at risk for cardiac arrest or brain damage. **Emergency Oxygen administration is a critical step** in treating a severe or life-threatening illness or injury."

-- ASHI (American Safety & Health Institute)

WHY Emergency OXYGEN?

Recommending authorities (for schools with pools/swim teams)

- "Providing high concentrations of oxygen to near-drowning victims in the first few minutes after rescue can prevent serious or even fatal complications. **Administering 100 percent oxygen first aid immediately after an accident improves the victim's survival chances.**"

-- Divers Alert Network (DAN)

WHY Emergency OXYGEN?

Recommending authorities

- "The physiological benefit of providing oxygen to spontaneously breathing drowning victims or during CPR in drowning victims in respiratory arrest is clear and advocates that **oxygen should be used in all drowning victims.**"

- International Life Saving Federation (ILSF)

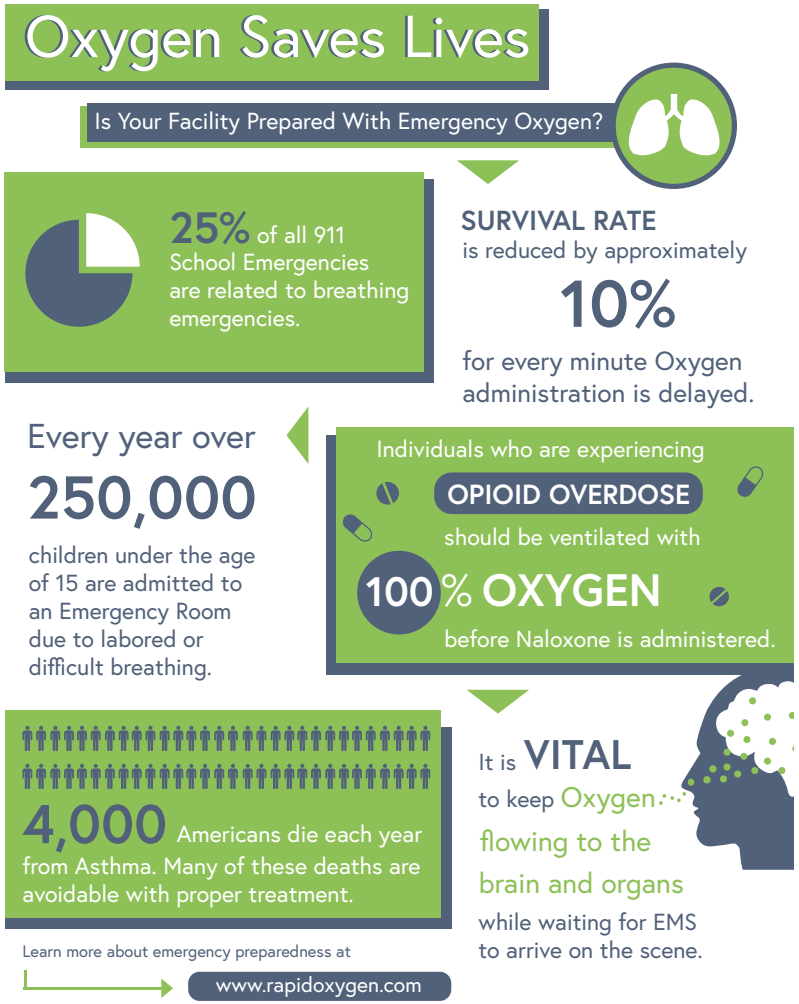
WHY Emergency OXYGEN?

Recommending authorities

- "Research studies have shown that the use of supplemental oxygen can aid in the care of accident victims. Life threatening medical emergencies are usually accompanied by low tissue oxygen levels (not enough oxygen to tissue and organs). If this progresses, the brain will begin to die first, with the other organs following. Additionally, low oxygen levels to the heart may lead to cardiac arrest. After opening the airway, **administering supplemental oxygen is the most important step in treatment.**"

-- YMCA of the USA, Medical Advisory Committee

WHY Emergency OXYGEN?



Every Minute Counts in an Emergency!

- **2 Minutes without Oxygen:**
  Permanent brain damage begins
- **8 Minutes Without Oxygen:**
  Risk of death
- School nurse or athletic trainer may be busy or far from victim
- ***Oxygen is Preventative:***
  "Oxygen can be critical response to many emergency situations and can be an effective first aid technique to prevent shock and cardiac arrest"
  Safe-Wise Consultants

WHY Public Access OXYGEN?

- "There are many potential benefits to the availability and utilization of emergency supplemental oxygen by civilian bystanders in a significant number of emergency situations."

  – Michael Kurz, MD, Associate Professor, Department of Emergency Medicine, University of Alabama School of Medicine

- "Since a significant number of breathing emergencies take place in public setting, the ability for bystanders to access and apply supplemental oxygen as a bridge to professional paramedical arrival after activating the 911 system I viewed as advantageous."

  – Kevin Ward, MD, Professor, Emergency Medicine and Biomedical Engineering, University of Michigan

- "Because first aid responders cannot tell if a victim who is deemed to have a significant medical emergency needs oxygen, and there is NO HARM providing it for the typical EMS response time, it should be administered!"

  – Pete Goldman, MD, former Director of Emergency Service, Andrews AFB

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Use cases for oxygen

- **Medical Events:** 240 MM 911 calls and 141 MM Annual ER patient visits occur in the U.S. annually
- **Use Types:** Airway and cardiac medical emergencies
- **Multiples of AED Uses:** 20x the number of respiratory vs cardiac events
- **Emergency Oxygen Applies to 7.7 MM Annual Medical Events in U.S.**
- **Preventative:** The lack of Oxygen can cause sudden and life-threatening medical conditions such as cardiac arrest

- Allergic Reaction
- Anemia
- Asthma
- Carbon Monoxide Poisoning
- Choking
- Concussion
- COPD Flare-Up
- Dehydration
- Drug Overdose (Combined w/Narcan)
- Drowning
- Heart Attack
- Heart Failure
- Heat Exhaustion
- Over Exertion
- Pneumonia
- Respiratory Attack
- Smoke or Chemical Inhalation

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Emergency oxygen is relevant

- Aircraft
- **Airports**
- Amusement Parks
- Banks
- Bus Terminals
- Casinos
- Churches
- **Community & Private Pools**
- Construction
- Daycare Centers
- Detention Centers/Jails
- **Fitness Clubs/YMCA's**
- Golf Clubs
- High Density Public Areas
- Homes
- Hotels
- Kids Activity Centers
- Law Firms
- **Manufacturers/Factories**
- Museums
- Oil & Gas Operations
- Police Departments
- Production Studios
- Real Estate Managers
- Recreational Boats
- Recreational Vehicles (RVs)
- Restaurants
- Retail Stores
- Retiree Residential Communities
- **Schools (K-12/Colleges)**
- Ships/Cruise Lines
- Shopping Centers
- Sport Stadiums
- Theaters
- Train Stations
- **Workplaces**

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SAMSHA* Opioid Tool Kit

5 Essential Steps for First Responders

Step 1: CALL FOR HELP (DIAL 911)

Step 2: CHECK FOR SIGNS OF OPIOID OVERDOSE

Step 3: SUPPORT THE PERSON'S BREATHING

Provide 100% O_2 before Naloxone is given to reduce the risk of lung injury

STEP 4: ADMINISTER NALAXONE

STEP 5: MONITOR THE PERSON'S RESPONSE

*Substance Abuse and Mental Health Services Administration

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Oxygen Delivery System Types

Oxygen
Most Widely Used Drug in Medical Emergencies

- Oxygen cylinders with pressurized O_2
- Oxygen concentrators
- Liquid oxygen – hospital piping systems
- Oxygen generating devices (e.g., Rapid Oxygen's R15)

Oxygen Cylinders: Not the solution for public places, as they are not permitted by law in open public spaces or where people gather

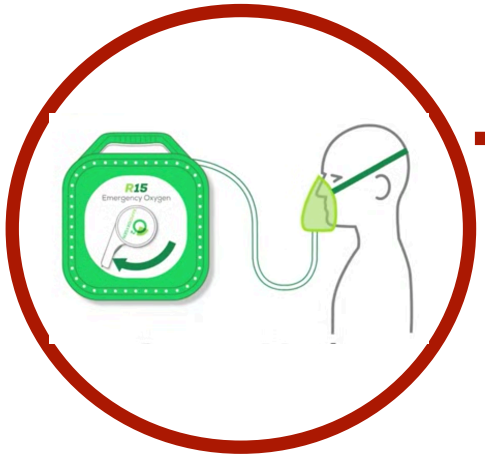
- **Prescription:** Oxygen cylinders also **require a prescription**
- **Storage:** Oxygen cylinders are required to be kept out of public's access in a secure and **fire protective cabinet**
- **Maintenance:** Oxygen cylinders **require servicing** to verify safety
- **Training:** Oxygen cylinders **require trained personnel**

Bridging the Gap

Immediate oxygen administration is being incorporated as a "Best Practice" because it bridges the gap between a breathing or cardiac event and the arrival of EMS, providing 100% Oxygen during the first critical minutes of any emergency.

10 Seconds:
Time it takes for the R15 to Begin Generating 100% Oxygen

Every Minute Counts



2 Minutes:
Permanent brain damage begins

8 Minutes:
Average time for first responders to arrive.

10 Minutes:
Most People die without oxygen

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Rapid Oxygen's R15

The Rapid Oxygen Company invented, manufactures and markets a patented OTC first aid device, FDA-cleared to provide 15 minutes of immediately accessible emergency oxygen for home safety, drug overdoses and other breathing and cardiac emergencies.

There are some places where pressurized oxygen is simply not permitted or appropriate

- **Safe:** Unlike Oxygen cylinders, the R15 is not explosive and can be used anywhere, by anyone (no prescription required)
- **Immediate:** Bridges gap between 911 call and EMS arrival
- **Accessible:** The R15 is permitted in public places and easily carried to a person in need
- **Simple:** No training required, activate in 3-simple steps
- **Companion:** Designed to be placed beside first aid kits, fire-extinguishers, automated external defibrillators (AEDs), and Naloxone
- **Risk Management:** R15 reduces liability as its availability demonstrates the operator pursues "Best Practices"

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Oxygen Delivery System Comparison

- R15 is not an Oxygen Cylinder, which requires a prescription, a trained technician to properly operate, and special storage due to being explosive
- The R15 generates Oxygen through a patented chemical reaction utilizing powders that are safe to handle, transport and store
- The key to the R15 is that it's safe, portable, non-explosive, stores anywhere, and can be operated by a child if needed

Metric	Gas Cylinders	Portable Oxygen Concentrators	R15
Non-dependent on Environment	✓	✗	✓
No Power Required	✓	✗	✓
>93% Oxygen Content	✓	✗	✓
Non-explosive	✗	✓	✓
No Operational Knowledge Required	✗	✓	✓
Allowed in Public Areas	✗	✓	✓
Cost-effective Transportation	✗	✗	✓
Over the Counter	✗	✗	✓
Easily Accessible in Emergencies	✗	✗	✓

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Oxygen Cylinder Gas Volumes vs R15

R15
90- 150 L

Older Name		A		B		C	D	JD	E			H
Newer Name	M-2	M-4	ML-6	M-6	M-7	M-9	M-15	M-22	M-24	M-60	M/MM/M122	M250
Diameter (in.)	2.5	3.2	4.3	3.2	4.3	4.3	4.3	5.3	4.3	7.3	8	9
Height (in.)	5.3	8.5	7.6	11.5	9.1	11	16.5	16.5	25.5	23	36	52
Empty Weight (lb)	0.7	1.6	2.8	2.2	3.3	3.7	5.3	8	7.9	22.3	39.5	114
Capacity (L) at 2,200psi	42	113	165	164	198	255	425	640	680	1738	3455	7080
Transport Method	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Carrier Bag	Wheelchair Bag or Cart	Not Portable	Not Portable	Not Portable
Regulator Type	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 870	CGA 540	CGA 540	CGA 540

Gas Cylinders:

- Deliver Cold/Dry Gas
- Require Training
- Require Maintenance
- Require a Prescription
- Vehicle Hazard
- Not Permitted in Public Places

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The R15 is Simple to Use

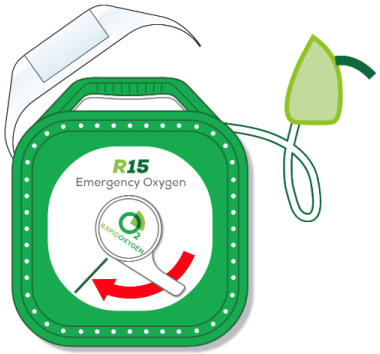
Simple Directions

1

Pull Tape

2

Turn the Handle



Initiates reaction, creating oxygen. Flow begins within 10 seconds.

3

Attach the Mask

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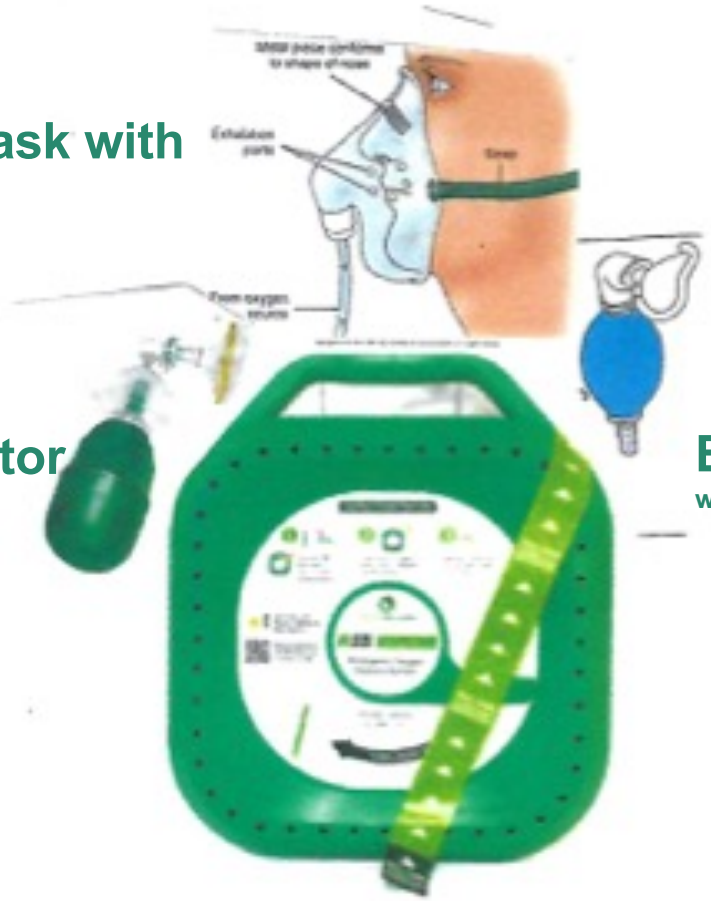
Simple O_2 Mask/Bag Mask Resuscitator

Simple O2 Mask with
breathing ports



Bag Mask Resuscitator
with connecting tube to reservoir

Bag Mask Resuscitator
with connecting tube to mask

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Emergency Oxygen: A Perfect Companion

Part of your emergency preparedness toolkit, from fire extinguishers to Naloxone, an EpiPen, Stop the Bleed Kits and AEDs

When a fire occurs, you call the fire department and then use a nearby fire extinguisher to control the fire…just as you would do using Rapid Oxygen's R15 in a medical emergency

Individuals who are experiencing an Opioid Overdose should be ventilated with 100% Oxygen before and after Naloxone is administered

AED locations are key installations for the R15

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For more info, visit RO2.Help