# Unit 4
# Oxygen Delivery Devices

## GOAL

**On completion of this unit, the student should have an understanding of the proper use of different oxygen delivery devices.**

## COMPETENCIES

1. Demonstrate proper techniques for applying oxygen administration devices.
2. Calculate the air-to-oxygen ratio in venturi masks.
3. Calculate total gas flow from venturi masks.
4. Analyze the delivered $F_{IO_2}$ from a venturi mask
5. Measure the total gas flow from a venturi mask.

## EQUIPMENT

1. oxygen administration devices
   a. nasal cannula
   b. medium concentration mask
   c. partial rebreathing mask
   d. nonrebreathing mask
   e. venturi mask
2. bubble humidifier
3. water
4. oxygen source
5. oxygen flowmeter with nipple
6. oxygen analyzer
7. Briggs' adaptor
8. two 6 inch flex tubes
9. respirometer
10. helium tank
11. helium regulator

## EXERCISE A - USE OF OXYGEN DELIVERY DEVICES

1. With your lab partner, demonstrate proper techniques for applying the following oxygen administration devices.

a. nasal cannula
b. medium concentration mask
c. partial rebreathing mask
d. nonrebreathing mask
e. venturi mask

## EXERCISE B - VENTURI MASK AIR-TO-OXYGEN RATIO CALCULATION

$$\frac{100 - \%O_2}{\%O_2 - 21} = \text{air}/O_2 \text{ ratio}$$

(use $\%O_2$-20 if $FIO_2 > .4$)

1. Calculate the air-to-oxygen ratio in a 40% venturi mask.
   a. $\text{air}/O_2 \text{ ratio} = \frac{100 - \_\_\_\_}{\_\_\_\_ - 21}$
   b. $\text{air}/O_2$ ratio =
2. Calculate the air-to-oxygen ratio in a 60% venturi mask.
   a. $\text{air}/O_2 \text{ ratio} = \frac{100 - \_\_\_\_}{\_\_\_\_ - 20}$
   b. $\text{air}/O_2$ ratio =

## EXERCISE C - VENTURI MASK TOTAL GAS FLOW CALCULATION

The amounts of air and oxygen that are mixed in a venturi to provide a specific oxygen concentration are expressed as a ratio (air:oxgen or a:o). The formula to determine the total gas flow from the device is:

(a x L/min.) + (o x L/min.)

1. Calculate total gas flow from a 40% venturi mask with an oxygen flow of 6 L/min.
   a. the air-to-oxygen ratio for 40% is ___: ___
   b. oxygen flow = ___ L/min.
   c. ( ___ x ___ ) + ( ___ x ___ ) = ___ L/min.
2. Calculate total gas flow from a 60% venturi mask with an oxygen flow of 8 L/min.
   a. the air-to-oxygen ratio for 60% is ___: ___
   b. oxygen flow = ___L/min.
   c. ( ___ x ___ ) + ( ___ x ___ ) = ____ L/min.

## EXERCISE D - VENTURI MASK DELIVERED $F_IO_2$ MEASUREMENT

1. Attach the appropriate oxygen diluter to the 6" flex tube.
2. Attach the connecting tubing to the venturi device and oxygen source.
3. Attach the oxygen analyzer to the 6" flex tube.
4. Adjust flowmeter to prescribed setting.
5. Analyze and record $F_IO_2$.

| Predicted $F_IO_2$ | $O_2$ flow (L/min.) | Measured $F_IO_2$ | $O_2$ flow (L/min.) | Measured $F_IO_2$ |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## EXERCISE E - VENTURI MASK TOTAL GAS FLOW MEASUREMENT

1. Attach the appropriate oxygen diluter to the 6" flex tube.
2. Attach the connecting tubing to the venturi device and oxygen source.
3. Attach the volume-measuring device to the 6" flex tube.
4. Adjust flowmeter to prescribed setting.
5. Turn on volume measuring device. Time for one minute.
6. Calculate and record liters per minute.

| Predicted $F_IO_2$ | $O_2$ flow (L/min.) | Predicted total flow (L/min.) | Measured total flow (L/min.) | $O_2$ flow (L/min.) | Predicted total flow (L/min.) | Measured total flow (L/min.) |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

## EXERCISE F – HELIOX THERAPY

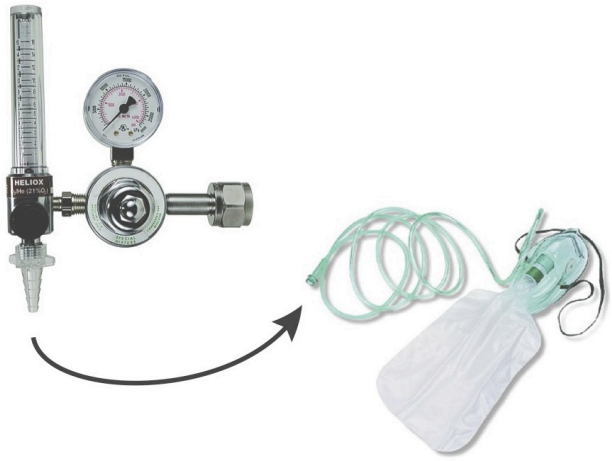
Heliox can be given as gas therapy or in conjunction with aerosolized medication therapy. Heliox tanks are usually delivered as 80/20, i.e 80% helium/20% oxygen. Oxygen can be titrated in to raise the $F_IO_2$.

With an 80/20 heliox tank, prescribed $F_IO_2$ can be mixed according to the following:

| *To mix:* | *Heliox flowmeter* | *Oxygen flowmeter* |
|---|---|---|
| 70% helium/30% oxygen | 12 L/min | 1.5 L/min |
| 60% helium/40% oxygen | 12 L/min | 4 L/min |

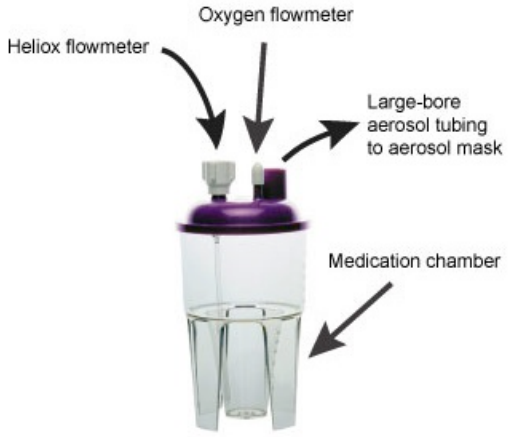
1. With the 80/20 heliox tank in our lab, setup the system to deliver 30% oxygen via nonrebreathing mask.

| *To mix:* | *Heliox flowmeter* | *Oxygen flowmeter* |
|---|---|---|
| 70% helium/30% oxygen | _____ L/min | _____ L/min |




2. With the 80/20 heliox tank in our lab, setup the system to deliver 40% oxygen via aerosol mask for a continuous medicated treatment.

| *To mix:* | *Heliox flowmeter* | *Oxygen flowmeter* |
|---|---|---|
| 60% helium/40% oxygen | _____ L/min | _____ L/min |



# WORKSHEET

1. Explain the difference between a high-flow and a low-flow oxygen delivery system. Give an example of each.

2. Why is the minimum flow rate of 5 L/min recommended for oxygen delivery by mask?

3. Calculate the air-to-oxygen ratio and total gas flow for a 24% venturi mask ($O_2$ flow = 12 L/min).

4. You observe a patient wearing a nonrebreathing mask and note that the bag completely deflates with each inspiration. What actions, if any, should you take?

5. List at least 3 factors that will affect the FiO2 delivered by a low-flow system.

6. Complete the following table by calculating or providing the missing parameters.

| $FiO_2$ | $O_2$ Flow Rate | Entrainment Ratio | Total Flow |
|---|---|---|---|
| 0.28 | 8 L/min | | |
| 0.40 | | | 40 L/min |
| | | 5:1 | 36 L/min |
| | 3 L/min | 7:1 | |
| 0.45 | 5 L/min | | |
| 0.50 | 14 L/min | | |
| 0.32 | 5 L/min | | |

7. Complete the following table.

**Nasal Cannula**

| | | |
|---|---|---|
| Liter Flow: | | |
| Estimated FIO2: | | |
| | Before Oxygen Administration | After Oxygen Administration |
| Pulse: | | |
| SpO2: | | |
| Respiratory Rate (f): | | |

**Simple Mask**

| | | |
|---|---|---|
| Liter Flow: | | |
| Estimated FIO2: | | |
| | Before Oxygen Administration | After Oxygen Administration |
| Pulse: | | |
| SpO2: | | |
| Respiratory Rate (f): | | |

**Partial Rebreather Mask**

| | | |
|---|---|---|
| Liter Flow: | | |
| Estimated FIO2: | | |
| | Before Oxygen Administration | After Oxygen Administration |
| Pulse: | | |
| SpO2: | | |
| Respiratory Rate (f): | | |

**Nonrebreathing Mask**

| | | |
|---|---|---|
| Liter Flow: | | |
| Estimated FIO2: | | |
| | Before Oxygen Administration | After Oxygen Administration |
| Pulse: | | |
| SpO2: | | |
| Respiratory Rate (f): | | |

**Venturi Mask**

| | | |
|---|---|---|
| Liter Flow: | | |
| Estimated FIO2: | | |
| | Before Oxygen Administration | After Oxygen Administration |
| Pulse: | | |
| SpO2: | | |
| Respiratory Rate (f): | | |