



Waitemata
District Health Board

Best Care for Everyone

Oxygen Workbook

Answer book

O₂ the fix, aim 92-96
If high CO₂, aim 88-92



#O2TheFix

1. Pre-workbook Quiz

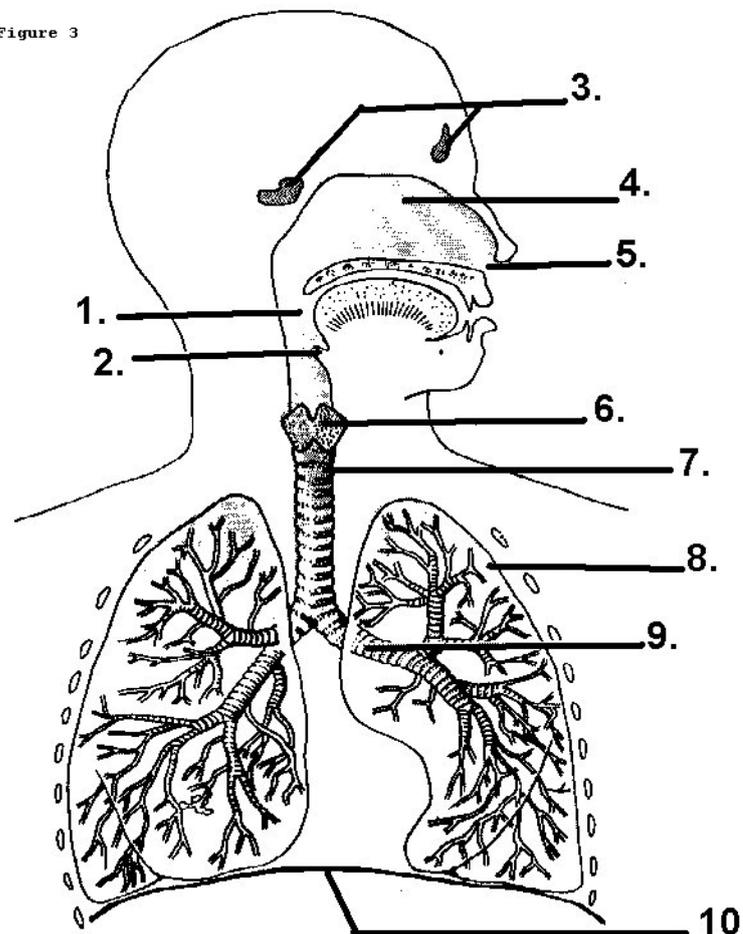
1. Oxygen is a drug? Y N maybe
2. Oxygen is a treatment for?
 breathlessness
 hypoxia
 high carbon dioxide
3. Humidified High Flow Nasal O₂ Therapy should be documented as 'Oxygen percentage'? Y N maybe
4. Can oxygen be given in an emergency without prescription? Y N maybe
5. The maximum amount of oxygen to be given through nasal prongs is?
 2L
 3L
 5L
6. What type of oxygen delivery system would normally be used in a self-ventilating patient with SaO₂ < 60%?
 nasal cannula
 Venturi mask
 Reservoir mask
 Hudson mask
7. A patient presents to ED with a 60 pack year smoking history, obesity and swollen ankles, his target saturations should be?
 98-100%
 90-95%
 88-92%
 92-96%
8. What are the target oxygen saturations for a 20 year old asthmatic patient who presents with an acute exacerbation of asthma?
 94-98%
 88-92%
 90-99%
 92-96%
9. 50 year old man with no previous medical history having ankle surgery is on a PCA, what are his target saturations?
 88-92%
 95-100%
 92-96%
10. A Venturi mask can be used as alternative to HHFNP? Y N
11. Which of the following devices can give controlled oxygen (i.e. with a fixed FiO₂)?
 Venturi mask
 Hudson mask
 Humidified High Flow Nasal Prongs (Airvo)
 nasal prongs

Exercise 1

Review the Respiratory System diagram
(You can find images on Google for Respiratory tract)

Identify each of the numbered areas; enter your answers in the table below.

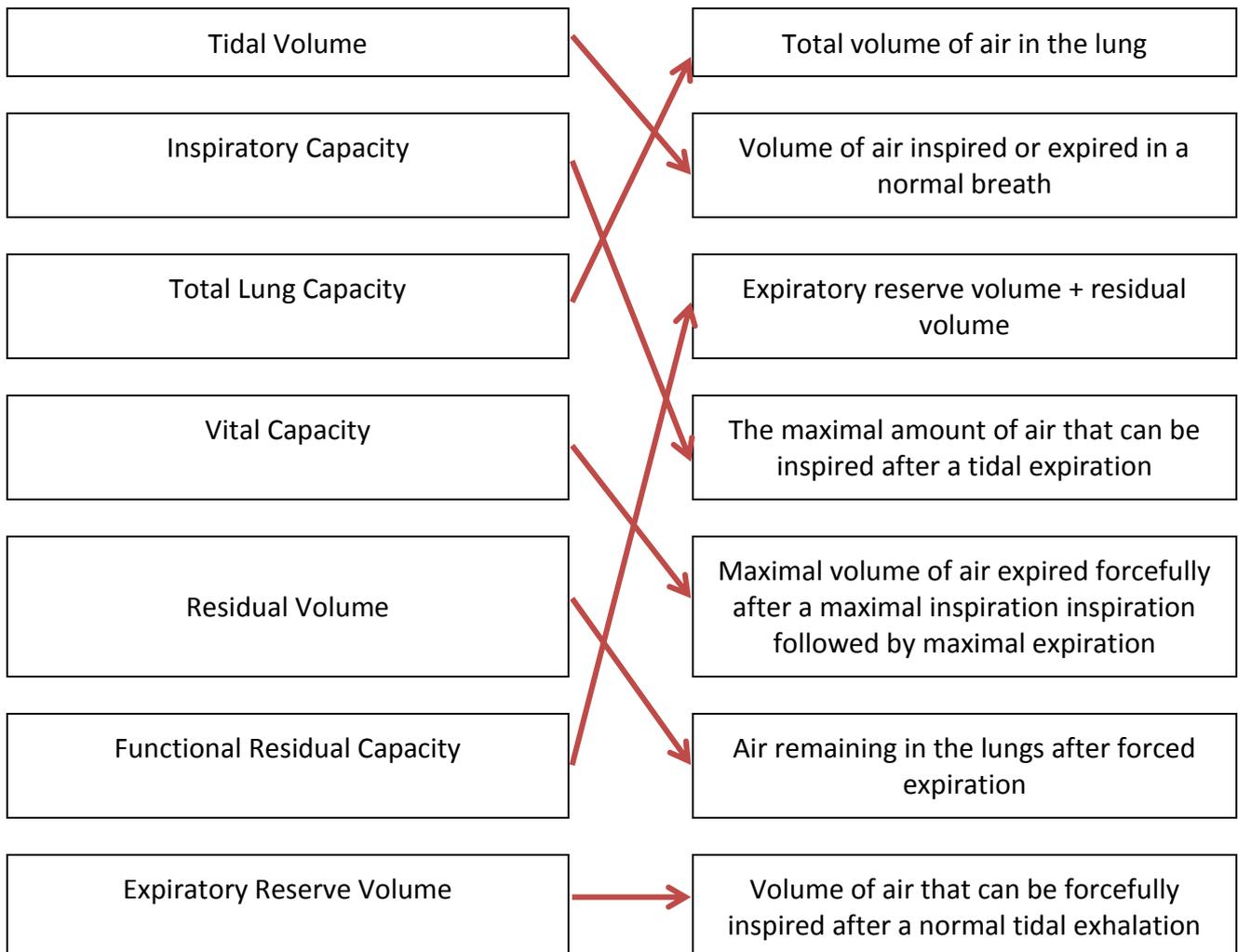
Figure 3



ANSWERS			
1	Pharynx	6	Larynx
2	Epiglottis	7	Trachea
3	Sinuses	8	Lung
4	Nasal passages	9	L) main bronchus
5	External nares	10	Diaphragm

Exercise 2 - Respiratory Anatomy & Physiology Quiz

Match by **drawing** a line between the pulmonary measurement and the correct definition.



Exercise 3 - Respiratory Anatomy & Physiology Quiz

Write your answers using the word bank below:

1. Parietal pleura lines the thoracic cavity.
2. Residual volume is the volume that remains after the most forceful exhalation (1200 ml).
3. A disease of the lungs in which the walls of alveoli lose elasticity and remain filled causing increased chest size (barrel-chested) is called Emphysem.
4. Breathing in; or inhaling is called inspiration.
5. Breathing out; exhaling is called expiration.
6. Difficult expiration caused by contraction in the muscles surrounding the bronchioles, often caused by allergic reactions, is called Asthma.
7. Inflammation of the bronchi is called Bronchitis.
8. Inflammation of the pleura is called Pleurisy.
9. Mucus in the respiratory system is pushed upward by cilia.
10. Normal breathing volume (normally about 500 ml. per breath) is called tidal volume.
11. Oxygen deficiency is called hypoxia.
12. Secondary bronchi branch into smaller tubes called bronchioles.
13. Sputum is another term for mucous.
14. The visceral pleura covers the lungs.
15. The apex is the narrow portion at the top of the lungs.
16. The inspiratory reserve volume is the volume that can be inhaled after normal inspiration

Word Bank - Apex, asthma, bronchioles, bronchitis, cilia, emphysema, expiration, hypoxia, inspiration, inspiratory reserve volume, mucous, pleurisy, residual, tidal volume, visceral. parietal.

Exercise 4 - Respiratory Anatomy & Physiology Quiz

Write your answers using the word bank below

1. The exchange of oxygen from blood to cells is called internal respiration.
2. The exchange of oxygen from air to blood is called external respiration.
3. The machine used to measure breathing volume is called a spirometer.
4. The maximum breathing volume is called vital capacity.
5. The membrane that lines the tubes in the respiratory system is called the respiratory mucosa.
6. The millions of tiny sacs that exchange oxygen and carbon dioxide are called alveoli.
7. The substance that coats the inside of the alveoli is called surfactant.
8. The two tubes that branch off the trachea are called the bronchi.
9. The volume that can be exhaled after expiring tidal volume (1000 – 1200 ml) is called expiratory reserve volume

Word Bank - Alveoli, expiratory reserve, external, internal, mucosa, primary bronchi, spirometer, surfactant, vital.

Exercise 5

Hypercapnic respiratory failure can be defined as $\text{PaO}_2 < 8 \text{ kPa}$ and $\text{PaCO}_2 > 6.0 \text{ kPa}$.

True

False

Treatments for respiratory failure include:

Bronchodilators

Antibiotics

oxygen

All of the above

Type II respiratory failure is the most common form of failure.

True

False

Name four causes for Type I respiratory failure.

- Low inspired FiO_2 (low atmospheric gas, seen in ventilated patients, high altitude)
- Cardiac shunt (left to right cardiac shunt as seen in atrial or ventricular septum defect)
- Diffusion limitation (as seen in interstitial lung disease)
- V/Q mismatch
 - Perfused but not ventilated, intrapulmonary shunt, consolidation, pneumonia, atelectasis
 - Perfused but partially ventilated e.g. COPD, severe asthma, pneumonia, pulmonary odema
 - Ventilated and partially perfused e.g hypoxaemia, shock, pulmonary vasoconstriction
 - Ventilated but unperfused e.g. pulmonary embolism

Which are treatments for respiratory failure?

- Treat underlying cause
- Control any airway obstruction
- Control secretions
- Give controlled oxygen as required
- Consider NIV for carbon dioxide control
- All of the above

Name four causes for Type II respiratory failure.

- Respiratory centre problems (CVA, tumour, central hypoventilation, over sedation with drugs)
- Muscle weakness (Guillain-Barre syndrome motor neurone disease, myasthenia gravis, muscular dystrophy, polio, spinal injuries, muscular fatigue as seen in obesity hypoventilation.
- Chest wall/pleural diseases (pneumothorax, kyphosis, massive pleural effusion, diaphragmatic paralysis)
- Airway disorder (Asthma, pneumonia, COPD, bronchiectasis/cystic fibrosis)

Name four signs and symptoms for respiratory failure.

1. Increased respiratory rate
2. Low oxygen levels in blood causing cyanosis and drop in SpO₂
3. Decreased level of consciousness
4. Increased levels of CO₂/confusion

2. Scenarios

Scenario - Mrs Brown

Mrs Brown is a 67 year old lady who has been admitted to your ward for supportive treatment of her COPD. Her blood gases in ED indicate that she is at risk of CO₂ retention. At the beginning of the shift her vitals were within normal range with unaltered NEWS of 0, and she was comfortable on room air, with no shortness of breath. At 1100hrs you check in on her and notice that she is pursed lip breathing, and showing signs of accessory muscle use. You record her vitals and note the following:

Heart Rate: 106 bpm, regular

Blood Pressure: 152/95

Respiratory rate: 28 breaths per minute

SpO₂: 82% on room air

Temperature: 36.7°C

You discuss this with the team house officer who suggests she may benefit from oxygen therapy.

Which device do you think would be most appropriate, and what flow rate/settings?

Controlled oxygen delivery device such as HHFNP or Venturi mask.

Start the HHFNP at standard airflow setting 35L/min and titrate wall oxygen to meet target saturations.

What would be the target saturations range for Mrs Brown? Explain your rationale.

88-92% as high risk of CO₂ retention/type 2 respiratory failure.

How would you document the oxygen therapy in her notes?

On HHFNP at 35L/min airflow, FiO₂ 28% with SpO₂ 90%

What would be your next steps if her oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">Alert team house officer and ICU outreach as per NEWS algorithm.Suggest ABG, +/- chest x-rayNebulisers as prescribedEnsure patient positioning optimisedConsider referral to physio for sputum clearance	<ul style="list-style-type: none">Continue to wear the oxygen down as long as SpO₂ are maintained between 88-92%Encourage mobilising/sitting out in chairContinue with usual standard treatments (nebs, prednisone, IVABx)

Scenario - Steve

Steve is a 35 year old admitted to your ward, with a history of asthma. While on the ward he mentions that he feels tightness in his chest and shortness of breath. He takes multiple breaths to tell you this information and there is an audible inspiratory wheeze. His respiratory rate is 28 breaths per minute, prior to receiving nebulised salbutamol and ipratropium. You re-check on him 15 minutes after he has finished his nebuliser and note the following:

Respiratory rate: 34 breaths / minute, audible wheeze

Heart rate: 123 beats/minute

SpO₂: 89% on room air

Blood pressure: 124/78

Temperature: 36.4°C

Steve is for full Resus, and as per the NEWS algorithm you place a 777 call, and notify the ICU outreach team.

What actions can you take while waiting for the team to respond?

Give further salbutamol or/and nebulisers

Sit patient upright

Give oxygen via simple face mask (>5-10L) to increase SpO₂ to 92-96%.

Reassure Steve and his family

Which device do you think would be most appropriate, and what flow rate/settings?

Give oxygen via simple face mask (>5-10L), if not meeting target saturations change to reservoir mask to increase oxygen delivery.

What would be the target saturations range for Steve? Explain your rationale.

92-96% as likely to be in type 1 respiratory failure and less risk of type 2 respiratory failures

How would you document the oxygen therapy in his notes?

Patient's SpO₂ = 94%, on 8L oxygen via Hudson mask

What would be your next steps if his oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">• Change oxygen delivery device to reservoir mask at 15L/min via wall oxygen.• Ensure immediate ICU review• Optimise patient positioning (i.e. high fowlers)	<ul style="list-style-type: none">• Change oxygen delivery device to standard nasal prongs, if meeting SpO₂ target.• Continue with nebulised therapy as per Asthma protocol

Scenario - Olivia

Olivia is a 42 year old healthcare worker who was admitted with bilateral pneumonia. She has been receiving Q8hrly IVAB's and has been on oxygen therapy, 2 litres/min via nasal prongs.

You go to administer her morning IVAB's and note that her respiratory rate is 24 resps / minute. You note that there are dry areas around her nostrils, and her e-prescribing record shows that her oxygen has been on for the past 24 hours since her admission, consistent at the rate prescribed.

You note that her respiratory rate has been within normal limits after her admission to the ward, and the record from ED shows that she had a respiratory rate of 25 on admission, which resolved with oxygen. Her SpO₂ has been consistent in the low 90's for the past 12 hours, but her increased respiratory rate has only just been noted.

Her current observations are:

Respiratory rate - 24 breaths/minute

Heart rate - 86 beats / minute

Blood Pressure – 132/76 mmHg

SpO₂ – 92% on 2 litres/minute oxygen via Nasal Prongs

Temperature – 37.2°C

You power-page the House Officer and advise them of the change in respiratory rate, and accompanying vitals.

Which device do you think would be most appropriate, and what flow rate/settings?

HHFNP, standard airflow rate of 35L/min. Titrate oxygen to target saturations.

What would be the target saturations range for Olivia? Explain your rationale.

92-96% Type 1 respiratory failure. No history to indicate risk of type 2 respiratory failure.

How would you document the oxygen therapy in her notes?

Patient on HHFNP at 35L airflow rate, FiO₂ 32% with SpO₂ 94%

What would be your next steps if her oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">• Escalate to team restart and ICU outreach as per NEWS algorithm• Increase wall oxygen flow arte to meet target saturations.• Consider increasing airflow rate on HHFNP to 40L/min.• Consider changing oxygen delivery device to simple mask• Optimize positioning (high side lying)• Ongoing treatment as prescribed	<ul style="list-style-type: none">• Wean wall oxygen down to room air while maintain target saturations.• Once HHFNP down to FiO₂ 21% either switch to nasal prongs at 1-2L or trial off oxygen altogether.• Continue to monitor as NEWS algorithm.

(nebs, IVABx)

- Reassure Olivia and her whanau/family

Scenario - Meredith

Meredith has been admitted to your ward with a plan for comfort cares, as she has end stage COPD, and has reached the ceiling of care provided. Her family have been involved in this decision, and have agreed to symptomatic care and support, including IVAB's and oxygen therapy. She is not for NEWS or vital signs.

You are advised by her daughter (next of kin), that she is sounding "rattly", and seems to be in some discomfort. You support the family to turn her, and give her some suctioning for the secretions you can hear causing the rattling that the daughter reported. She is receiving oxygen via a face mask at 6 litres/minute, which she has been receiving continuously for the past 36 hours. You notice that she is using accessory muscles, and, despite the secretions, you note that she is dry on the lips and around the mouth. You count her respiratory rate, which is 32 respirations per minute and find that her SpO₂ is 80%

You page the house officer to advise them of what you have observed.

Which device do you think would be most appropriate, and what flow rate/settings?

A controlled oxygen delivery device such as Humidified High Flow Nasal Prongs for humidification and comfort or venturi mask if unable to tolerate HHFNP

What would be the target saturations range for Meredith? Explain your rationale.

88-92% as she is a COPD patient at risk of CO₂ retention.

How would you document the oxygen therapy in her notes?

HHFNP, standard airflow rate of 35L/min. Titrate oxygen to target saturations.

What would be your next steps if her oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">Given her plan for comfort cares, between the patient, her family and the team, Meredith may opt to cease oxygen or use a different delivery device.	<ul style="list-style-type: none">Wean oxygen to a Stop and document successful wean in notes

Scenario - Adam

Adam is a 45 year old man admitted to your ward for pain management. You are looking after him for an afternoon shift, and have just taken handover from the morning nurse. For his pain he is charted:

- IV Morphine, as per protocol 0.5mg-2.0mg every 5 minutes, PRN
- Sevredol, 20mg, PO, Q1hrly, PRN
- Paracetamol, 1gm, Q6hrly, regularly
- Codeine, 60mg, PO, Q6hrly, PRN

During the handover the morning nurse tells you that he has required regular morphine throughout the shift for his pain, as well as having Sevredol. The nurse states that he was consistently complaining of 8/10 pain throughout the shift, which is why he was having these doses. When rounding was done half an hour ago he was in 5/10 pain, and alert. His e-vitals record shows that his respiratory rate has been between 15 and 18 throughout the shift. His vitals have all been within normal limits.

You go with the morning nurse to the bedside to introduce yourself to the patient, and find that he is unresponsive, has a respiratory rate of 6 breaths per minute, and is cyanosed on the lips.

You press the emergency bell and the morning nurse goes to call 777.

What actions can you take while waiting for the team to respond?

Apply oxygen via reservoir mask at 15L to maintain saturations range of 92-96%.
call for extra help
Obtain resus trolley and prepare naloxone in case required when team arrive

Which device do you think would be most appropriate, and what flow rate/settings?

Either reservoir mask or Ambubag at 15L

What would be the target saturations range for Steve? Explain your rationale.

92-96%. Steve has no respiratory history or risk factors for CO₂ retention that we know of.

How would you document the oxygen therapy in his notes?

Document Litres of Oxygen at flow metre and device in use

What would be your next steps if his oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">• Apply appropriate oxygen delivery device to maintain oxygen saturations at 92-96%• Inform medical team and ICU outreach as per NEWS algorithm of increased requirement for oxygen	<ul style="list-style-type: none">• Wean oxygen to a Stop and document successful wean in notes

Scenario - Jennifer

Jennifer is a 67 year old female who has a L) NOF repair following mechanical fall and fracture. Her medical history consists of osteoporosis, hypertension and diverticulitis. She is on the ward 4 hours post op; she has a PCA in situ and is drowsy with a GCS of 15/15. She hasn't used her PCA for the last half hour and claims her pain is 2/10 on the pain scale. She has oxygen prescribed via the NOF protocol and has O₂, 2L via simple nasal cannulae in situ.

Her current observations are:

Respiratory rate - 24 breaths/minute

Heart rate - 90 beats / minute

Blood Pressure – 127/65 mmHg

SpO₂ – 96% on 2 litres/minute oxygen via Nasal Prongs

Temperature – 36.0°C

What is the most appropriate course of action in this situation?

Wean off oxygen, decrease to 1 L and check oxygen 10-15 later, if still within target saturations range then stop O₂ and check again in a further 10-15 minutes.

What would be the target saturations range for Jennifer? Explain your rationale.

92-96%. Jennifer has no respiratory history or risk factors for CO₂ retention

How would you document the oxygen therapy in her notes?

SpO₂ 96% on 2L/min O₂ via nasal cannula

What would be your next steps if her oxygen requirements increase/decrease?

Increase	Decrease
<ul style="list-style-type: none">Apply appropriate oxygen delivery device to maintain oxygen saturations at 92-96%Inform medical team and ICU outreach as per NEWS algorithm of increased requirement for oxygen.	<ul style="list-style-type: none">Stop oxygen therapy and document successful wean in notes



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