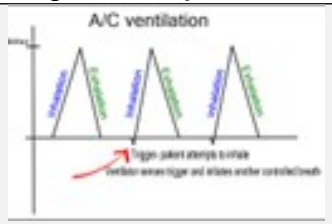
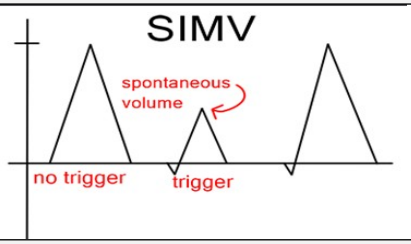
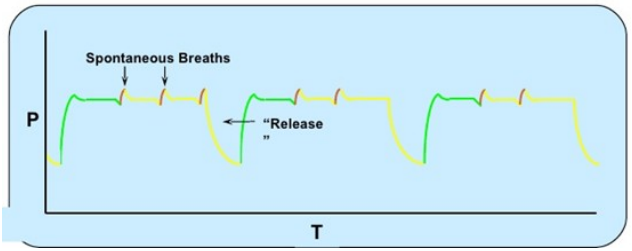
Mechanical Ventilation

Ventilator Terminology			
f/RR – frequency/respiratory rate (12-20 bpm)			
FIO2 – fraction/percent of inspired oxygen			
I:E Ratio – inspiratory time compared to expiratory time (1:2)			
PEEP – positive end-expiratory pressure (5 -10 cm H2O)			
Ve – minute ventilation/volume (Vt x RR) (6-8 L/min)			
PIP – peak inspiratory pressure (15-20 cmH2O)			
Vt – tidal volume (6 -8 mL/kg – Ideal Body Weight) - (very sick lungs – use 4 to 6 mL/kg)			
	Mode	**Description**	**Diagram Example**
AC	Assist Control	▪ A full support mode; Controls the work of breathing ▪ AC provides a fixed tidal Volume (VT) that the ventilator will deliver at set intervals of time or when the patient initiates a breath ▪ Vt (tidal volume) will remain the same for patient-initiated breath or ventilator breath	
SIMV	Synchronized intermittent mandatory ventilation	▪ Allows patient to **spontaneously** breathe **without** ventilator assistance ▪ Delivers a **preset Vt, RR, FIO_2, PEEP** ▪ The number of ventilator breaths are reduced as the patient improves ▪ Tidal volume (Vt) will vary; Used as a weaning mode	
PRVC	Pressure regulated volume control	▪ The ventilator uses both volume and pressure to automatically adjust to the patient's ventilatory needs breath by breath. ▪ Volume is guaranteed but the ventilator increases or decreases the pressure to guarantee the volume set to protect lungs ▪ Used when lungs are stiff, yet a certain volume needs to be achieved each time	
PS	Pressure Support	▪ A set airway pressure to assist the patient with spontaneous breaths ▪ Usually set at 5-15 cmH_2O ▪ Decreases work of breathing by giving the patient a little boost on the breaths they initiate on their own ▪ Pressure support is decreased as the patient improves	

CPAP	Continuous positive airway pressure	▪ Functionally similar to PEEP ▪ A preset pressure is provided throughout both the inspiratory and expiratory phases of the breath ▪ Keeps alveoli from collapsing, resulting in better oxygenation and less work of breathing ▪ Only provides airway pressure; Patient must be able to breath spontaneously	
BIPAP		▪ Noninvasive positive pressure ventilation that delivers a preset inspiratory (IPAP) and a preset expiratory pressure (EPAP) ▪ Used to ventilate non-intubated patients to help prevent intubation ▪ Patient must be able to spontaneously breathe and cooperate with this treatment ▪ Setting include Fio2 and 2 pressure settings **I**nspiratory pressure (IPAP); assist ventilation **E**xpiratory pressure (EPAP); assists oxygenation	
APRV	Airway pressure release ventilation	▪ High continuous positive pressure delivered for a long duration and then falls to a lower pressure for a shorter duration ▪ Alveolar recruitment is maximized by the high continuous pressure ▪ Decreases the risk of pressure related lung injuries ▪ No set RR or TV; patient should not be heavily sedated or paralyzed ▪ Patient can spontaneously breathe at any time	

Ventilator Alarms

Alarm	Potential Causes	Interventions
High peak inspiratory pressure (PIP)	✓ Blockage of Et tube (secretions, food, kinked tubing, patient biting on ET tube ✓ Coughing ✓ Bronchospasm ✓ Lower airway obstruction ✓ Pulmonary edema ✓ Pneumothorax ✓ Ventilator/patient dyssynchrony	✓ Assess breath lungs ✓ Suction airway ✓ Insert bite block or administer sedation per orders if patient is agitated or biting on ETT
Low pressure alarm	✓ Air leak and ventilator circuit or in the ET tube cuff	✓ Locate leak in system ✓ Check pilot balloon as indicator of ET tube cuff

		failure
Apnea	✓ Breaths not being taken by the patient or triggered on the ventilator	✓ Assess patient effort ✓ Check system for disconnections
Complications Related to Mechanical Ventilation		
Patient Complications	**Potential Causes**	**Intervention**
Cardiovascular issues	Decrease in venous return to heart due to positive pressure applied to lungs	Assess patient for adequate fluid volume Monitor for decrease in BP
Barotrauma/pneumothorax	Positive pressure applied to lungs Elevated mean airway pressure may rupture alveoli	Assess bilateral lung sounds; chest rise and fall Notify HCP Prepare for possible chest tube insertion
Infection	Breaks in ventilator circuit Decreased mobility Impaired cough reflex	Use aseptic technique HOB 30-45 degrees unless contraindicated; Provide sedation vacation and assess patient readiness for extubation; Provide oral care q 4 hrs. Support proper nutritional status

Common Ventilator Alarms	
Low-Pressure Alarm	**Intervention**
Cuff leak	Assess for cuff leak, check cuff pressure, call RT and physician
Leak in the ventilator circuit	Assess all connections and tubing; call RT and physician, a new ventilator may be needed
Patient stops breathing in pressure support modes of SIMV	Assess the patient; notify RT and physician; may need to provide manual breathes via BVM
Unintentional extubation	Assess patient for need to be reintubated; apply oxygen; may need to give manual breathes via BVM
Tube disconnected from circuit	Reconnect tubing to circuit; assess patient
Barotrauma	Assess subcutaneous emphysema - notify RT and physician if present
High-Pressure Alarm	**Intervention**
Mucous plug or increased secretions	Suction as needed
Patient bites ETT	Insert an oral airway to prevent biting (bite block)
Pneumothorax	Assess for asymmetrical chest rise, decreased breath sounds over pneumothorax site; notify physician
Patient anxious and fighting the ventilator	Assess the patient, provide emotional support, re-evaluate sedation/analgesic need

Kink in the tubing	Assess the tubing from ventilator to patient to ensure no kinking of the tube is present
Water collected in the ventilator tubing	Empty the water from the tubing
Patient is coughing	Continue to monitor
Bronchospasm	Assess for non-productive consistent coughing; give a breathing treatment
Pulmonary Edema	Assess lung sounds and ETT for fluid; suction if needed, consult physician for potential prone patient placement & diuretics
Decreased lung compliance	Assess lung sounds, RR, BP and SaO2; notify RT & physician, ventilator mode may need to be changed