Formulas and Calculations Cheat Sheet
Here are the formulas and calculations that you will see in Respiratory Therapy school. They’re also the ones that will be on the TMC Exam as well. Luckily though, there won’t be many (only 2-3 total) on the exam.*

*This is one of our most recommend #Hacks from the book, *Hacking the TMC Board Exam*

**Ideal Body Weight**

**IDW** = 50 kg + (2 x # of inches over 5 ft. tall)

**Tobacco Use**

Pack years = (# of packs per day) X (# of years smoked)

**Cerebral Perfusion Pressure (CPP)**

CPP = MAP – ICP

**Heart Rate for an ECG Strip**

HR = 300 / # of large boxes between R waves

**Mean Arterial Pressure (MAP)**

MAP = ([2 x diastolic] + systolic) / 3

**Cardiac Output (Q_t)**

Q_t = heart rate X stroke volume
**Stroke Volume**

Stroke volume = $Q_T / \text{heart rate}$

**Cardiac Index**

$CI = \text{cardiac output} / \text{body surface area}$

**Systemic Vascular Resistance (SVR)**

$SVR = (MAP - CVP) / \text{cardiac output}$

**Pulmonary Vascular Resistance (PVR)**

$PVR = (MPAP - PCWP) / \text{cardiac output}$

**Alveolar Air Equation**

$PAO_2 = (PB - P_{H_2O}) \times FiO_2 - (PaCO_2 / 0.8)$

**A-a Gradient**

$A-aDO_2 = PAO_2 - PaO_2$

**P/F Ratio**

$P/F \text{ Ratio} = PaO_2 / FiO_2$

**Arterial Oxygen Content**
CaO₂ = (Hb x 1.34 x SaO₂) + (PaO₂ x 0.003)

**Mixed Venous Oxygen Content**

CvO₂ = (Hb x 1.34 x SvO₂) + (PvO₂ x 0.003)

**Arterial-Venous Oxygen Content Difference**

C(a-v)O₂ = CaO₂ – CvO₂

**Shunt Equation**

\[ \frac{Q_s}{Q_t} = \frac{(A-aDO₂ \times 0.003)}{([A-aDO₂ \times 0.003] + C(a-c)O₂)} \]

**Arterial Oxygen Saturation** – you can estimate the SaO₂ from a given PaO₂, as long as the PaO₂ is between 40 – 60 torr.

\[ SaO₂ = PaO₂ + 30 \]

**Oxygenation Index**

\[ OI = \left( \frac{[Paw \times FiO2]}{PaCO2} \right) \times 100 \]

**Deadspace to Tidal Volume Ratio** – “PACO minus PICO over PACO”

\[ VD/VT = \frac{(PaCO₂ – PECO₂)}{PaCO₂} \]

**Suction Catheter Size**
Catheter Size = (ID/2) X 3

**Estimate FiO2 with a Nasal Cannula** – for every 1 L/min in flowrate, the FiO₂ increases by 4%.

\[ 20 + (4 \times \text{liter flow}) = \text{FiO₂} \]

**Duration of Cylinder Flow**

Duration = (gauge pressure X tank factor) / liter flow

**Tank Factors to know**

- E cylinder = 0.28 L/psi
- H cylinder = 3.14 L/psi

**Air-to-Oxygen entrainment ratios:**

<table>
<thead>
<tr>
<th>FiO2</th>
<th>Ratio</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>25:1</td>
<td>26</td>
</tr>
<tr>
<td>28</td>
<td>10:1</td>
<td>11</td>
</tr>
<tr>
<td>32</td>
<td>6:1</td>
<td>7</td>
</tr>
<tr>
<td>35</td>
<td>4.6:1</td>
<td>5.6</td>
</tr>
<tr>
<td>36</td>
<td>4:1</td>
<td>5</td>
</tr>
<tr>
<td>40</td>
<td>3:1</td>
<td>4</td>
</tr>
<tr>
<td>60</td>
<td>1:1</td>
<td>2</td>
</tr>
<tr>
<td>70</td>
<td>0.6:1</td>
<td>1.6</td>
</tr>
<tr>
<td>100</td>
<td>0:1</td>
<td>1</td>
</tr>
</tbody>
</table>
Total Flow

Total flow = factor X liter flow

Exhaled Tidal Volume

\[ V_T = \frac{V_E}{f} \]

Minute Ventilation

\[ V_E = \text{rate} \times \text{tidal volume} \]

Alveolar Minute Ventilation

\[(\text{tidal volume} - \text{dead space}) \times \text{rate}\]

Dynamic Compliance

\[ \frac{\text{Tidal volume}}{(\text{PIP} - \text{PEEP})} \]

Static Compliance

\[ \frac{\text{Tidal volume}}{(\text{Plateau pressure} - \text{PEEP})} \]

Airway Resistance

\[ \text{Raw} = \text{Peak pressure} - \text{Plateau pressure} \]

Work of Breathing
WOB = (change in pressure X change in volume)

Rapid Shallow Breathing Index

RSBI = rate / tidal volume

Heliox Mixtures

Actual flow = given flow X factor

Volume Lost Through Chest Tubes

Delivered $V_T$ – Exhaled $V_T$ = Lost volume

Heart Rate Max

HRmax = 220 – age

Respiratory Quotient

$RQ = \frac{VCO_2}{VO_2}$

Drug Dilution Calculation

# of mg/mL = Drug % x 10

80/20 mixture: 1.8
70/30 mixture: 1.7
Conclusion

If you learn these formulas and calculations, you’ll be on your way to acing the exams in your RT school classes, and when the time comes for you to take the TMC Exam, you’ll be prepared to get all the math questions correct.

I hope this cheat sheet was helpful.

When you’re ready to start preparing for the TMC Exam, be sure to check out our best study resources, the TMC Test Bank and our TMC Study Guide. They can definitely help you pass on your first attempt.

Good luck with everything!