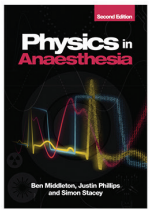
Chapter 8

Measurement of gas flow



Self-assessment questions

These questions and answers, in both MTF and SBA formats, accompany *Physics in Anaesthesia 2e* and link back to the book for guidance.

Multiple true / false questions

For each of the following questions, mark all answers as either true or false

1. The relationship between driving pressure and flow rate is:

- **a.** Directly proportional in laminar flow
- **b.** Not constant in turbulent flow
- **c.** Constant at high velocities
- **d.** Determined by the resistance which in turn is directly proportional to length of the tube
- **e.** Used in the rotating-vane flowmeter

Pointer

- See *Equations 8.3* and *8.7*.

2. With regards to the Reynolds number (*Re*):

- **a.** The faster a fluid flows, the higher the *Re*
- **b.** The more viscous a fluid, the lower the *Re*
- **c.** Units are $L \cdot s^{-1}$
- **d.** Ohm's law applies to flow regardless of the value of *Re*
- **e.** The more dense a fluid, the lower the *Re*

Pointer

- See *Equation 8.6*.

3. Regarding respiratory volume flowmeters:

- **a.** A Wright peak flow meter is the most commonly used spirometer
- **b.** A rotating-vane flowmeter is most accurate for high respiratory flow rates
- **c.** Volume measured in a rotating-vane flowmeter can be integrated by converting voltage to flow and integrating the result with respect to time
- **d.** A pitot tube flowmeter can measure flow in both directions
- **e.** Measuring volume directly generally underestimates expired volume

Did you know?

- A peak flow meter is one of the most reliable tools for monitoring chronic asthma.

Single best answer questions

For each of the following questions, select the single best answer – note that more than one answer may be true but only one option represents the best answer

1. In the large airways of the lung turbulent flow dominates because:

- **a.** Flow is driven by a pressure difference across a resistance
- **b.** It requires less driving pressure
- **c.** The diameter is wider, leading to lower velocities
- **d.** The diameter is wider, leading to higher flow rates
- **e.** There is a higher pressure difference, leading to higher flow rates

Did you know?

- Even though individually smaller airways have much higher resistance to flow (Hagen–Poiseuille law) the highest total resistance is actually in the trachea and larger bronchi.
- This is due to the overall number of branches of smaller airways running in parallel, reducing the total resistance to air flow.

2. At the point of stenosis in an artery, with regards to potential and kinetic energy, velocity and pressure of the fluid:

a. There is an increase in velocity and thus a higher ratio of kinetic energy to potential energy
b. The stenosis creates a resistance to flow
c. There is more turbulent flow as a result of higher velocities
d. The pressure exerted on the walls of the artery across the area of the stenosis is increased
e. There is a lower ratio of kinetic energy to potential energy due to increased pressure at the stenosis

Pointer

- Think Bernoulli's principle.

Reminder

- Kinetic energy is related to a fluid's velocity.
- Potential energy is related to the pressure the fluid exerts.

3. What can change the air entrainment rate through a Venturi mask aperture?

a. The Coanda effect explains how the valves produce a mixture of air and oxygen
b. The larger the aperture of the valve, the faster the rate of air entrainment
c. The Venturi effect is a special case of the Bernoulli principle
d. If oxygen is delivered at 35% there is a lower entrainment rate than if oxygen is being delivered at 40%
e. The rate of flow of oxygen through the Venturi value

Pointer

- See *Table 8.1*.

4. A fluid logic ventilator works without any moving parts in the valve because it relies on:

a. Electrical resistance
b. Gravity
c. The Coanda effect
d. Ohm's law
e. Jet entrainment

Did you know?

- This phenomenon can explain why a mucus plug in the trachea can result in the collapse of one side of the lung.
- This is due to unequal air distribution at the tracheo-bronchial bifurcation.

Answers to questions for Chapter 8 – Measurement of gas flow

Multiple true / false questions

The following answers are true:

1. a and d

2. a and b

3. a, c, d and e

Single best answer questions

The options below represent the single best answer, although other options may also be true:

1. d

2. a

3. b

4. c