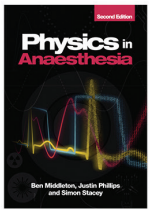
Chapter 6

Pressure measurement



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.

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Multiple true / false questions

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

1. Which are equal to atmospheric pressure at sea level?

a. 760 mmHg
b. 103.1 kPa
c. 1000 mBar
d. 1033 cmH_2O
e. 1 atm

Did you know?

- Measurement of atmospheric (or barometric) pressure at sea level is also dependent on temperature with 15°C being the reference point.

2. As a mercury barometer is taken up to the summit of Mt Everest:

a. The height of the mercury column decreases
b. The pressure at the closed end of the tube is almost zero
c. The hydrostatic pressure of the mercury decreases
d. The hydrostatic pressure of the mercury balances the pressure on the reservoir
e. The temperature has no effect on the length of the column

Pointer

- See *Table 6.1* for conversion of units of pressure.

Did you know?

- Atmospheric pressure is 33.7 kPa at the summit of Mt Everest, far lower than the atmospheric pressure as sea level, 101.3 kPa.

3. The pressure exerted by a spring-loaded diaphragm in a pressure relief valve is proportional to the:

a. Extension
b. Surface area
c. Spring constant
d. Inverse of the spring constant
e. Inverse of the extension

Pointer

- See *Equation 6.6*.

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. If an oxygen cylinder's pressure regulator was removed prior to connecting it to the piping of a ventilator:

a. The pressure supplied to the ventilator would remain set at 400 kPa
b. The high pressure of the cylinder could cause potential damage to the low-pressure ventilator piping
c. As the cylinder emptied the pressure supplied would fall
d. The pressure supply would be variable
e. There would be an initial very high pressure surge of oxygen gas risking damage to the ventilator equipment and surroundings, including people in the vicinity

Did you know?

- A full cylinder of oxygen has a pressure of around 13 700 kPa.
- Gas cylinders hold gas at very high pressures (relative to atmospheric pressure) and if the gases are allowed to escape rapidly, the potential energy within the cylinder will be converted into kinetic energy, causing the cylinder to propel like a rocket.
- See *Table 3.1* for the different forms of energy.

2. A patient spikes a fever intra-operatively and an infusion of paracetamol is prescribed. The nurse punctures the bung with both a needle and the spike of a giving set; the paracetamol bottle is then hung upside down on a drip stand above the patient and the end of the giving set is attached to a lumen on the patient's central venous catheter (CVC). What is the best description of how the infusion flows?

a. The bung on the glass bottle of paracetamol acts as a pressure regulator valve

b. The needle puncture in the bung creates an air vent enabling air to ingress into the bottle via the siphon effect, keeping the pressure inside the bottle at atmospheric pressure and forcing fluid into the CVC

c. Without the needle puncture there would be a risk of air embolism

d. There is free flow of the fluid with this method

e. The patient is at risk of an air embolism if the infusion is not closely monitored and stopped when the bottle is empty

Did you know?

- Although rare, air embolisms can be fatal.
- Symptoms of an air embolism can include dyspnoea, chest pain, altered mental status, seizures, hemiplegia.

3. An arterial catheter is inserted into a patient's radial artery. The invasive systolic blood pressure reading is lower, and the diastolic higher, than the non-invasive blood pressure readings. What best explains this discrepancy?

a. The arterial line is critically damped

b. The resistance to fluid flow and inertia of the liquid play a part

c. There is too little damping of the system and this may be due to the line being too short or too wide

d. There is overdamping of the system and a potential troubleshooting solution would be to flush the line

e. Moving the transducer lower than the level of the heart will increase the blood pressure reading

Did you know?

- Square wave test/fast flush tests whether a transducer system is optimised: oscillations on the arterial line waveform following the square wave form should be noted.
- The number of oscillations observed on the arterial line tracing after the fast flush test can be an indication of whether a transducer system is overdamped and underdamped.
- See *Sections 5.4* and *5.5* for more on harmonics and damping.

Answers to questions for Chapter 6 – Pressure measurement

Multiple true / false questions

The following answers are true:

1. a, b, d and e

2. a, b, c and d

3. a, b and c

Single best answer questions

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

1. e

2. b

3. d