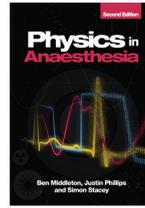


# Chapter 4

## Temperature and heat



### 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. A body of emissivity 0.8 compared to a body of emissivity 0.4:

- a. Is a better emitter and a less good absorber of thermal radiation
- b. Is a better emitter and a better absorber of thermal radiation
- c. Is a better emitter but the absorptive abilities are not known
- d. Is more likely to be visibly lighter
- e. Is more likely to be visibly darker

#### Reminder

- The emissivity of a black body (the hypothetical best possible absorber / emitter) is 1.
- See *Section 4.4*.

#### 2. If a patient with a brain injury from an ischaemic stroke develops a chest infection resulting in an increased respiratory rate and fever spike:

- a. Active warming of the patient further would minimise the ischaemic insult
- b. Turning on a fan on the patient's bedside would be classified as passive convection
- c. The patient has an increased metabolic rate due to their physiological response to the chest infection
- d. Preventing hyperthermia minimises the ischaemic insult
- e. A hospital blanket with more knitted holes would keep the patient warmer than one with fewer holes

#### Did you know?

- Fever following an acute stroke is associated with poor outcomes.

#### Pointer

- See *Section 4.3*.

#### 3. Regarding the pros of using thermistors:

- a. The non-linear relationship between temperature and resistance makes for easy temperature calculations
- b. They are cheap
- c. They have a rapid response time
- d. Readings can be taken continuously
- e. Readings can be taken from the ear and axilla

#### Reminder

- Thermistor probes are commonly placed in the nasopharynx, oesophagus, rectum or bladder.

#### Did you know?

- In all anaesthesia over 30 minutes it is recommended to monitor core body temperature.
- Thermistor probes are the most commonly used devices for this.

## 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. With regard to the power an object radiates:

- It is proportional to  $T^2$
- The Stefan constant is a measure of entropy
- It is proportional to  $T^4$ , emissivity, surface area of the body
- The higher the temperature of a body the more power it radiates
- It is proportional to  $T^4$ , entropy, surface area of the body

#### Reminder

- Emissivity is the ability of a body to radiate heat.
- Entropy is a measure of disorder or the unavailability of a system to do work.
- The most probable state of a system is that with largest entropy – simply put, everything tends towards chaos.
- Both emissivity and entropy are dimensionless quantities and thus they have no units.

#### Did you know?

- As entropy always increases with time its measurement is a way of distinguishing from the past.

### 2. On a cold day, metal feels colder to the touch than wood because:

- The metal has a higher specific heat capacity on a cold day
- The metal is at a lower temperature than the wood
- The metal is a better thermal conductor than the wood
- The metal has a lower specific heat capacity than the wood
- The metal contains less heat than the wood

#### Reminder

- Specific heat capacity is generally a constant for any given substance.
- Two objects in the same environment have the same temperature.
- Metals have low specific heat capacities making them easy to heat up.

### 3. Warming a shivering, hypothermic patient wrapped in a reflective blanket is effective because:

- The thermal radiation they are emitting is reflected back to them by the blanket
- Their shivering increases their metabolic rate
- There is convection between the molecules of the skin and that of the reflective blanket
- The reflective blanket is a good conductor
- The reflective blanket is a good insulator

# Answers to questions for Chapter 4 – Temperature and heat

## Multiple true / false questions

*The following answers are true:*

1. b and e
2. c, d and e
3. b, c and d

## Single best answer questions

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

1. c
2. c
3. a