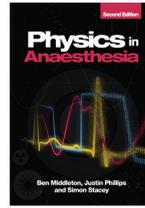


Chapter 5

Waves



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. Regarding the properties of waves:

- Longitudinal waves are longer than transverse waves
- As the frequency of a wave increases, so does its wavelength
- Sound travels slower in a vacuum than in air
- Light travels faster in a vacuum than in air
- Electromagnetic waves have oscillating magnetic and electric fields that are perpendicular to the direction of travel

Reminder

- Mechanical waves propagate through a medium carrying energy from one place to another.
- For this reason sound waves cannot travel in a vacuum, unlike electromagnetic waves.

Did you know?

- The energy that waves carry can be harnessed.
- The amount of power that can be harnessed per square metre in a day from ocean waves is approximately a hundred times the energy generated from wind.

2. Regarding electromagnetic waves:

- They can exist as both waves and particles
- Photons are bursts of energy
- X-ray and infrared waves travel at the same speed in a vacuum
- Radio waves are used in radiotherapy
- The eye is more sensitive to the visible light waves of violet–blue colour

Reminder

- All electromagnetic waves travel at the speed of light in a vacuum.
- Ionising waves are waves with the highest frequencies.

Did you know?

- Types of radiotherapy, such as X-rays and gamma rays, employ high frequency, high energy photons / electromagnetic waves to irradiate diseased tissue.
- Particle radiation (electron, proton or neutrons) can also be used.

3. A child is being pushed on a swing hanging 1.5 m below the stand:

- The period of each swing would be longer if the swing hung at 2 m below the stand
- The swing would be critically damped if forced back to its equilibrium and its movement stopped
- A well-timed push of increasing effort could cause the amplitude of each swing to increase
- The acceleration of the swing is proportional to the displacement
- The velocity of the swing is at zero when at maximum displacement

Reminder

- The simple harmonic of a swing follows that of a sine wave (see *Figure 5.9*).

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. Choose the list of electromagnetic waves that is in order of increasing wavelength:

- a. Visible light, ultraviolet, infrared
- b. Infrared, infrasonic, microwaves, radio waves
- c. Red light, green light, yellow light
- d. Gamma, X-ray, ultraviolet, visible light
- e. Gamma, ultrasonic, microwaves, radio waves

Reminder

- The wavelength is inversely proportional to the frequency.
- Soundwaves are not electromagnetic waves.

Pointer

- See Figure 5.6.

Did you know?

- Green is the most sensitive and easily visible light to the human eye.
- Green light has been found to reduce mistakes in theatres.

2. The Doppler effect has what effect on the sound waves from a moving source when observed by a stationary observer?

- a. Change in frequency, wavelength and velocity
- b. Change in frequency and wavelength
- c. Change in velocity and wavelength
- d. Change in velocity and frequency
- e. Change in frequency

Did you know?

- The red and blue colours that appear when using an ultrasound Doppler are frequently misinterpreted as depicting arterial and venous blood flow.
- The colours are actually a representation of the direction of blood flow in relation to the Doppler probe: red meaning the blood is flowing towards the probe, and blue the blood is flowing away.

3. A surgeon asks his assistant to manoeuvre the overhead lamp closer to the patient's abdomen. In doing so:

- a. The intensity of the light on the abdomen increases
- b. The radiant flux of the light remains unchanged
- c. The radiant flux of the light decreases
- d. The intensity of light on the abdomen increases whilst the radiant flux and luminance flux remain unchanged
- e. The intensity of light, the radiant flux and the luminance flux remain unchanged

Pointer

- See Equation 5.6.

Answers to questions for Chapter 5 – Waves

Multiple true / false questions

The following answers are true:

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