

Radio to gamma waves and digital signals

Grade 8 science (Year 9 · Class 8) · Test answers (mark scheme)

Use these model answers and the marking notes to score your test. Give a mark only for the points that are written, and use the notes to see which part of the chapter to revise.

Level: Grade 8 science (Year 9 · Class 8) · **Curriculum:** MS-PS4-3

Question 1 Ordering waves (2 marks)

- a. Microwaves, visible light, X-rays.
- b. Microwaves.

Marking: (a) 1 mark for the correct order; (b) 1 mark for microwaves.

Question 2 Radio wave calculation (3 marks)

- a. $v = f \times \lambda$.
- b. $f = v \div \lambda = 3.0 \times 10^8 \div 2.0 = 1.5 \times 10^8 \text{ Hz}$.

Marking: (a) 1 mark; (b) 1 mark for substitution, 1 mark for $1.5 \times 10^8 \text{ Hz}$ with unit.

Question 3 Uses of waves (2 marks)

- a. For example a TV remote control or a thermal camera.
- b. For example sterilising water or checking security markings.

Marking: 1 mark for each valid use.

Question 4 Danger of X-rays (2 marks)

- a. X-rays are ionising, so they can knock electrons out of atoms and damage the DNA in cells, which may cause cancer.
- b. Lead absorbs X-rays, so it stops them reaching the radiographer.

Marking: (a) 1 mark for ionising and damages cells; (b) 1 mark for lead absorbs X-rays.

Question 5 Noisy digital signal (3 marks)

- a. 10011010.
- b. Every pulse is clearly above or below the threshold, so the receiver can still decide whether each is a 1 or a 0.

- c. Noise can be removed from a digital signal by regeneration (or digital signals carry more information).

Marking: (a) 1 mark; (b) 1 mark; (c) 1 mark.

Question 6 Binary (3 marks)

- a. $8 + 0 + 0 + 1 = 9$.
b. $14 = 8 + 4 + 2$, so 1110.
c. $2^3 = 8$ values.

Marking: 1 mark for each correct answer.

Question 7 Speed of gamma rays (2 marks)

All EM waves travel at the same speed, 3.0×10^8 m/s, in a vacuum. Gamma rays differ from radio waves in having a higher frequency and a shorter wavelength, not a higher speed.

Marking: 1 mark for the same speed; 1 mark for higher frequency and shorter wavelength as the real difference.

Question 8 Radar pulse (2 marks)

Distance there and back = $2 \times 15\,000 = 3.0 \times 10^4$ m. Time = $3.0 \times 10^4 \div 3.0 \times 10^8 = 1.0 \times 10^{-4}$ s.

Marking: 1 mark for doubling the distance; 1 mark for 1.0×10^{-4} s with unit.

Question 9 Mobile signal (1 mark)

Microwaves.

Marking: 1 mark for microwaves.