

# National 5 Physics Open-Ended Questions Sample Answers

1

Please Note: The following sample answers are provided to support your self-marking of physics past papers and should give you an idea of the types of answers expected. However, there may be other acceptable answers that I haven't included, and usually you wouldn't need to write everything I have included to get 3 marks.

2

# 2014 Q7

3

7. A fire engine on its way to an emergency is travelling along a main street. The siren on the fire engine is sounding.

A student standing in a nearby street cannot see the fire engine but can hear the siren.



Use your knowledge of physics to comment on why the student can hear the siren even though the fire engine is not in view.

3

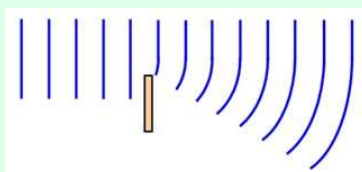
4

Possible answers may include:

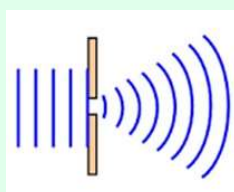
- The speed of sound in air ( $340 \text{ ms}^{-1}$ ) is much smaller than the speed of light in air ( $3 \times 10^8 \text{ ms}^{-1}$ ). This means that the sound waves will travel slower than the light waves in air.
- Sound is a longitudinal wave, whereas light is a transverse wave.
- Longitudinal waves are waves in which the particles move along the same direction as the wave. Transverse waves are waves in which the particles move at  $90^\circ$  to the direction of travel of the wave.
- Some of the sound from the fire engine could be reflecting off of nearby buildings.
- The sound waves from the siren will continue to travel until they are absorbed by something, such as a wall or a person.
- The student is likely standing in a location where the sound waves from the siren are not being blocked by anything, so they are able to hear the siren even though they cannot see the fire engine.
- Reflection of light could also allow the student to see the fire engine at times.

5

- Diffraction is the bending of waves through a gap or around an obstacle.
- Both sound and light waves can undergo diffraction, depending on the situation.
- Sound waves have longer wavelengths (lower frequencies) than light waves, so will diffract around the corner allowing the student to hear the siren. For example:



- Light waves have shorter wavelengths (higher frequencies) than sound waves, so will only diffract when they pass through very narrow gaps/slits. For example:



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