Higher Doppler Effect and Red Shift Answers

1. a) The **change in the frequency of sound observed** when a source of sound waves is

moving relative to the observer.

b) An emergency services vehicle with its siren on coming towards or away from you.

2. a) i)

$$f_o = f_s\left(\frac{v}{v - v_s}\right)$$

ii) As the source moves **towards** the observer the frequency of the sound reaching the

observer increases. The denominator **(v – v$_s$)** gets smaller and so **f$_o$ increases**.

b) i)

$$f_o = f_s\left(\frac{v}{v + v_s}\right)$$

ii) As the source **moves away** from the observer the frequency of the sound reaching the

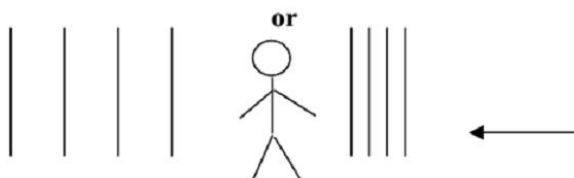observer decreases. The denominator **(v + v$_s$)** gets bigger and so **f$_o$ decreases**.

3. a) f = 1037Hz.

b) f = 966Hz.

4. a) The frequency of the sound heard by the observer increases as the train comes towards

them and then decreases as it moves away from them.

b)

The waves (wavefronts) are closer together as they
approach the person
then they are further apart after they pass the person

or

c) V$_{train}$ = 20ms^{-1}.

5. a) $f = 307$Hz.

b) $f = 265$Hz.

6. a) $V_{car} = 14$ms^{-1}.

b) $f = 461$Hz.

7. <u>**Red Shift**</u> -> Red light has a high wavelength and a low frequency.

In the Doppler Effect the **low frequency** means that the star or Galaxy are **moving away from you**.

<u>**Blue Shift**</u> -> Blue light has a low wavelength and a high frequency.

In the Doppler Effect the **high frequency** means that the star or Galaxy are **moving towards you**.

8. If the **Red Shift Ratio** is **positive** then the star or Galaxy are moving **away from you**.

If the **Red Shift Ratio** is **negative** then the star or Galaxy are moving **towards you**.

9. a) $Z = + 0.07$.

b) $\lambda = 520$nm.

10. a) $Z = + 0.18$.

b) $v = 5.4 \times 10^7$ms^{-1}.

11. a) $Z = + 0.025$

b) $v = 7.5 \times 10^6$ms^{-1}.

12. Frequency increases or **blue shift** when the **star approaches**.

Frequency decreases or **red shift** when the **star recedes** i.e moves away from us.