Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Waves Homework Assignment 3

Level 3

90520 Demonstrate understanding of wave systems

Credits: Four

Answer **ALL** the questions in the spaces provided.

If you need more space for any answer, use the pages provided at the back of this booklet and clearly number the question.

For all numerical answers, full working should be shown and the answer should be rounded to the correct number of significant figures and given with an SI unit.

For all 'describe' or 'explain' questions, the answer should be in complete sentences with all logic fully explained.

You may find the following formulae useful

$d \sin\theta = n\lambda$ $\quad n\lambda = \frac{dx}{L}$ $\quad f' = f\frac{v_w}{v_w \pm v_s}$

$v = f\lambda$ $\quad f = \frac{1}{T}$

NZIP 2008
QUESTION TWO

John found an electronic siren tied to a length is string. When it was switched on the siren emitted a single frequency note. John started to swing the siren, still emitting its single frequency note, around his head in a horizontal circle. Fred was in the room at the time and the note he heard as the siren came towards him had a different frequency from the note he heard as the siren went away from him.

(a) Name what is happening in this situation.

_____

(b) The siren is emitting a note of frequency of 249 Hz as it circles with constant speed. The frequency of the note heard by Fred as the siren is coming towards him is 255 Hz. The speed of sound in air is 330 m s^{-1}. Calculate the frequency of the note Fred hears as the siren is moving away from him.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Asses sor's use only

NZIP 2005

QUESTION THREE: DOPPLER EFFECT

The traffic police speed radar uses the idea of Doppler Effect to check the speed of oncoming cars.

(a) Describe the phenomenon of **"Doppler Effect"**.

_____

_____

The transmitter in the speed radar sends out microwaves of frequency **1.276×10^{10} Hz**. The speed of the wave is **3.00×10^{8} ms^{-1}**.

(b) Calculate the **wavelength** of the microwaves. Write down your answer to the correct number of significant figures.

_____

_____

_____

_____ Wavelength = _____

(c) A traffic police car is parked by the road side. The policeman in the car sees an ambulance approaching. The speed radar shows that the ambulance is approaching him at a constant speed of **25.0 ms^{-1}**. The actual frequency of the siren is **63 Hz**. The speed of sound in air is **330ms^{-1}**. Calculate the **apparent frequency** of the sound waves heard by the policeman.

_____

_____

_____

_____ Apparent frequency = _____

(d) Explain why the apparent frequency of sound heard by the policeman is different from the actual frequency of the siren.

_____

_____

_____

_____

NZIP 2004

QUESTION TWO: VOYAGER SPACECRAFT

NASA launched the Voyager 1 interstellar mission in 1977. The twin Voyager 1 and 2 spacecraft opened new vistas in space by greatly expanding our knowledge of Jupiter and Saturn and beyond.

At more than thirteen billion kilometres from the sun, Voyager 1 is the most distant object from Earth built by humanity. Both craft are still sending back data.

(a) The frequency of a radio signal sent from Voyager 1 would be higher than the apparent frequency received on earth. Name the phenomenon that causes this?

_____

(b) Explain why the signal received on earth will be at a lower frequency than that emitted by the Voyager craft.

_____

_____

_____

_____

(c) Calculate the frequency of the signal received on Earth from Voyager 1 if the transmission frequency is 4.00000×10^6 Hz. The spacecraft is travelling away from Earth at a speed of 28 853 ms^{-1}.

(use c=299 792 458 ms^{-1}) Ignore relativistic effects.

_____

_____

_____

_____

(d) Explain how NASA scientists can measure the difference in frequency between two waves.

_____

_____

_____

_____