Doppler Effect: Exam Revision Tracker

Attempt #1		Attempt #2		Attempt #3		Attempt #4		Attempt #5	
Total	Score	Total	Score	Total	Score	Total	Score	Total	Score
12		13		13		10		11	
Percentage =		Percentage =		Percentage =		Percentage =		Percentage =	

Doppler Effect: Attempt #1

Total = 12 Marks

The siren of a stationary ambulance emits sound waves at a constant frequency of 680 Hz. A man is standing with a detector that records the wavelength of the sound emitted by the siren, as shown in the diagram below.

The speed of sound in air is 340 $m \cdot s^{-1}$.

1. Calculate the wavelength of the detected sound. (3)

The ambulance now moves at a constant speed along the road TOWARDS the man. The detector now records the wavelength of the sound, which differs from the previous reading by 0,05 m.

2. State the Doppler effect. (2)

3. How would EACH of the following have changed when the ambulance approached the detector compared to when the ambulance was stationary?

Choose from INCREASED, DECREASED or NO CHANGE.

3.1 Distance between the wave fronts (1)

3.2 Frequency of the detected waves (1)

4. Calculate the speed of the ambulance. (5)

Doppler Effect: Attempt #2

Total = 13 Marks

The alarm of a vehicle parked next to a straight horizontal road goes off, emitting sound with a wavelength of 0,34 m. A patrol car is moving at a constant speed on the same road. The driver of the patrol car hears a sound with a frequency of 50 Hz **lower than** the sound emitted by the alarm. Take the speed of sound in air as 340 $m \cdot s^{-1}$.

1. State the Doppler effect in words. (2)

2. Is the patrol car driving TOWARDS or AWAY FROM the parked vehicle? Give a reason for the answer. (2)

3. Calculate the frequency of the sound emitted by the alarm. (3)

4. The patrol car moves a distance of *x* metres in 10 seconds. Calculate the distance *x*. (6)

Doppler Effect: Attempt #3

Total = 13 Marks

1. An ambulance is moving towards a stationary listener at a constant speed of 30 $m \cdot s^{-1}$. The siren of the ambulance emits sound waves having a wavelength of 0,28 m. Take the speed of sound in air as 340 $m \cdot s^{-1}$.

1.1 State the Doppler effect in words. (2)

1.2 Calculate the frequency of the sound waves emitted by the siren as heard by the ambulance driver. (3)

1.3 Calculate the frequency of the sound waves emitted by the siren as heard by the listener. (5)

1.4 How would the answer to QUESTION 6.1.3 change if the speed of the ambulance were LESS THAN 30 $m \cdot s^{-1}$? Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

2. An observation of the spectrum of a distant star shows that it is moving away from the Earth.

Explain, in terms of the frequencies of the spectral lines, how it is possible to conclude that the star is moving away from the Earth. (2)

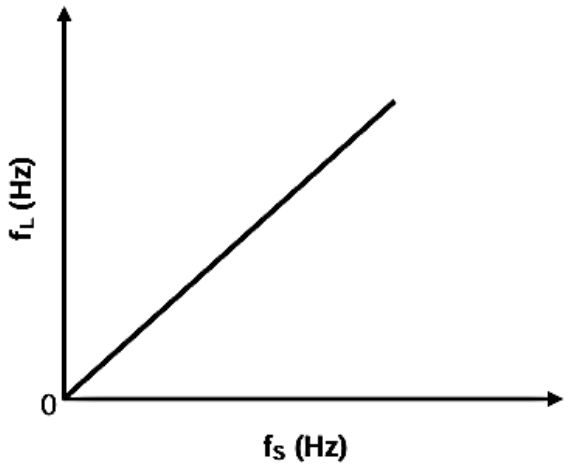
Doppler Effect: Attempt #4

Total = 10 Marks

A learner investigates the relationship between the observed frequency and the frequency of sound waves emitted by a stationary source.

The learner moves towards the source at a constant velocity and records the observed frequency (f_L) for a given source frequency (f_S) . This process is repeated for different frequencies of the source, with the learner moving at the same constant velocity each time.

The graph below shows how the observed frequency changes as the frequency of sound waves emitted by the source changes.



1. Name the phenomenon illustrated by the graph. (1)

2. Name ONE application in the medical field of the phenomenon in QUESTION 6.1. (1)

3. Write down the type of proportionality that exists between $\mathbf{f_L}$ and $\mathbf{f_S}$, as illustrated by the graph. (1)

4. The gradient of the graph obtained is found to be 1,06.

If the speed of sound in air is 340 $m \cdot s^{-1}$, calculate the magnitude of the velocity at which the learner approaches the source. (5)

The investigation is now repeated with the learner moving at a HIGHER constant velocity towards the sound source.

5. Copy the graph above in your ANSWER BOOK and label it as **A**. On the same set of axes, sketch the graph that will be obtained when the learner is moving at the HIGHER velocity. Label this graph as **B**. (2)

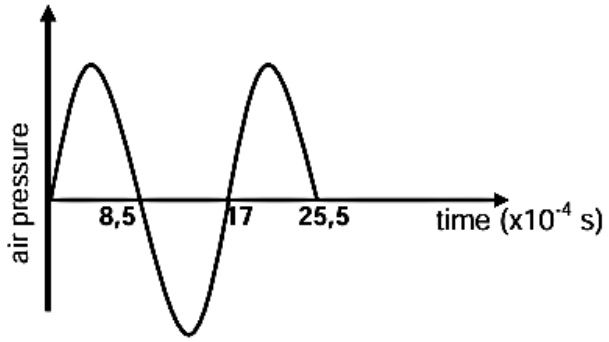
Doppler Effect: Attempt #5

Total = 11 Marks

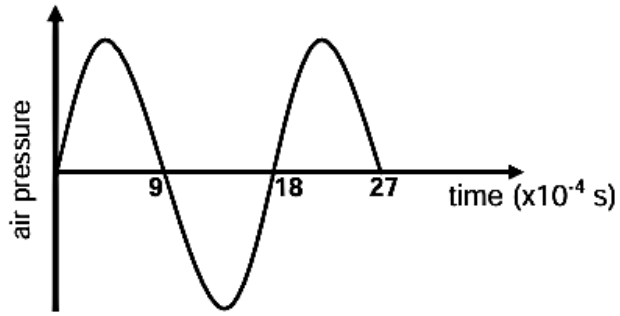
The siren of a police car, which is travelling at a constant speed along a straight horizontal road, emits sound waves of constant frequency. Detector **P** is placed inside the police car and detector **Q** is placed next to the road at a certain distance away from the car. The two detectors record the changes in the air pressure readings caused by the sound waves emitted by the siren as a function of time.

The graphs below were obtained from the recorded results.

GRAPH A: AIR PRESSURE VS TIME RECORDED BY DETECTOR P IN THE CAR



GRAPH B: AIR PRESSURE VS TIME RECORDED BY DETECTOR Q NEXT TO THE ROAD



1. Different patterns are shown above for the same sound wave emitted by the siren. What phenomenon is illustrated by the two detectors showing the different patterns? (1)

The police car is moving AWAY from detector **Q**.

2. Use the graphs and give a reason why it can be confirmed that the police car is moving away from detector **Q**. (1)

3. Calculate the frequency of the sound waves recorded by detector **P**. (3)

4. Use the information in the graphs to calculate the speed of the police car. Take the speed of sound in air as 340 m·s^{-1}. (6)

Doppler Effect: Bonus Attempt ⚡

Total = 11 Marks

1. The data below was obtained during an investigation into the relationship between the different velocities of a moving sound source and the frequencies detected by a stationary listener for **each** velocity. The effect of wind was ignored in this investigation.

Experiment number	1	2	3	4
Velocity of the sound source ($m \cdot s^{-1}$)	0	10	20	30
Frequency (Hz) of the sound detected by the stationary listener	900	874	850	827

1.1 Write down the dependent variable for this investigation. (1)

1.2 State the Doppler effect in words. (2)

1.3 Was the sound source moving TOWARDS or AWAY FROM the listener? Give a reason for the answer. (2)

1.4 Use the information in the table to calculate the speed of sound during the investigation. (5)

2. The spectral lines of a distant star are shifted towards the longer wavelengths of light. Is the star moving TOWARDS or AWAY FROM the Earth? (1)