9.5 Doppler Effect

Question Paper

Course	DP IB Physics
Section	9. Wave Phenomena (HL only)
Topic	9.5 Doppler Effect
Difficulty	Easy

Time allowed: 20

Score: /10

Percentage: /100

Question 1

A train is moving towards a stationary observer. The train sounds its horn.

What are the correct changes in frequency, wavelength and pitch of the horn as heard by the observer?

	frequency	wavelength	pitch
A.	higher	shorter	higher
B.	higher	shorter	lower
C.	lower	shorter	lower
D.	lower	longer	higher

[1 mark]

Question 2

A team of naturalists are researching the movement of whales in the ocean. They plan to calculate the velocity of a whale using the Doppler effect. The whale pod is moving towards the research team who are in a stationary boat.

Which equation will allow the researchers to investigate the velocity of the whales using the frequency of sound in water?

A. $\lambda' = \lambda \left(1 + \dfrac{u_s}{v} \right)$

B. $f' = f \left(\dfrac{v}{v + u_s} \right)$
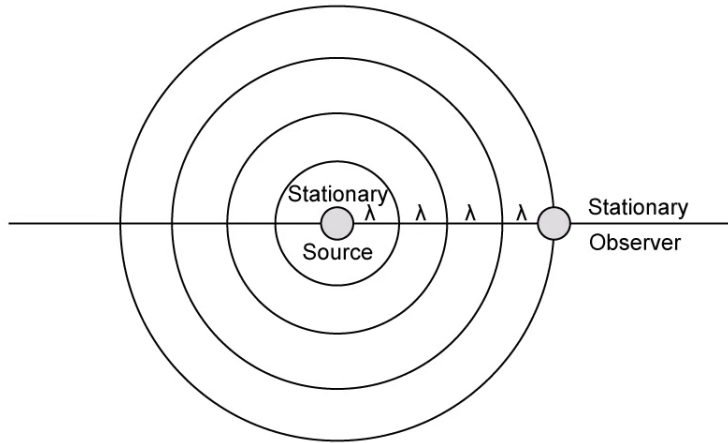
C. $f' = f \left(\dfrac{v + u_0}{v} \right)$

D. $f' = f \left(\dfrac{v}{v - u_s} \right)$
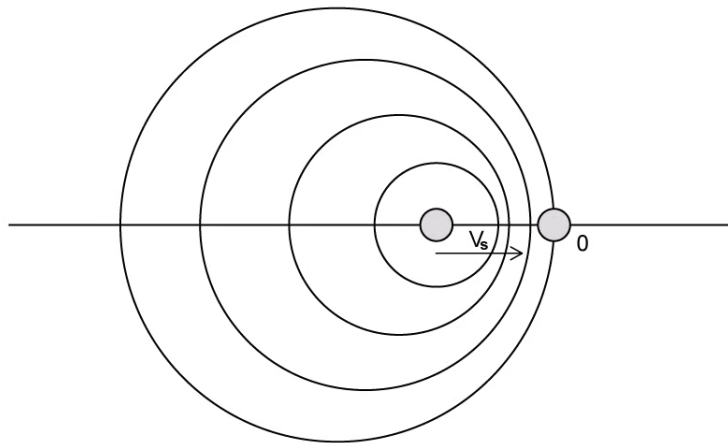
[1 mark]

Question 3

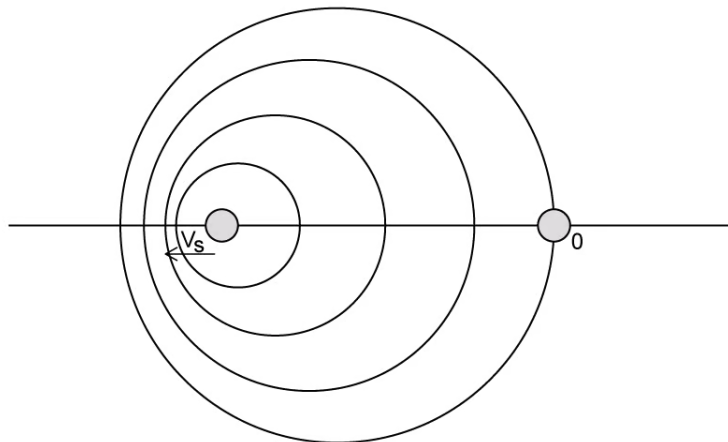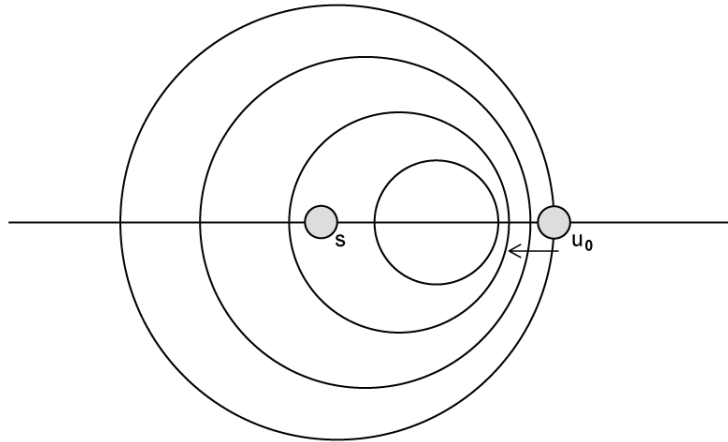Which diagram correctly represents redshift?

A.

B.

C.

D.

[1 mark]

Question 4

What did the discovery of the Doppler redshift give scientists evidence for?

    A. Newton's Third Law

    B. The formation of solar systems

    C. The Big Bang

    D. Blueshift

[1 mark]

Question 5

Which equation can be used to calculate the Doppler shift for the sound of a person running away from an observer whilst blowing a whistle?

A. $f' = f\left(\dfrac{v + u_0}{v}\right)$

B. $f' = f\left(\dfrac{v}{v - u_s}\right)$

C. $f' = f\left(\dfrac{v - u_0}{v}\right)$

D. $f' = f\left(\dfrac{v}{v + u_s}\right)$

[1 mark]

Question 6

Which of the following is not a use of the Doppler effect?

    A. Mapping the expansion of the universe

    B. Measuring the rate of blood flow in patients

    C. Finding planetary orbits around distant stars

    D. Recording the speed of sound

[1 mark]

Question 7

Which statement about redshift is true?

    A. Redshift shows all galaxies are moving towards the Earth

    B. Redshift shows that the space between galaxies is expanding

    C. Redshift is the change in pitch of the sound waves emitted from galaxies

    D. Redshift is the expansion of stars

[1 mark]

Question 8

Which of the following equations will give an increase in the frequency of the observed wave according to the Doppler Effect?

A. $f' = f\left(\dfrac{v - u_o}{v}\right)$

B. $\lambda' = \lambda\left(1 + \dfrac{u_s}{v}\right)$

C. $f' = f\left(\dfrac{v + u_o}{v}\right)$

D. $f' = f\left(\dfrac{v}{v + u_s}\right)$

[1 mark]

Question 9

Which of the following statements about the Doppler effect is correct?

A. When a galaxy moves towards the Earth the spectral absorption lines observed will have a longer wavelength

B. When a car starts to move away from an observer, the sound from the exhaust appears at a lower frequency to the observer than the driver

C. When a train moves towards a station, it's horn will sound lower to the passengers on the platform compared to the passengers in the train

D. Light from a star moving towards the Earth is redshifted

[1 mark]

Question 10

Which of the following is an equation to calculate the Doppler shift of light?

A. $\dfrac{\Delta f}{f} \approx \dfrac{c}{v}$

B. $\dfrac{f}{\Delta f} \approx \dfrac{v}{c}$

C. $\dfrac{v}{f} \approx \dfrac{c}{\Delta f}$

D. $\dfrac{\Delta f}{f} \approx \dfrac{v}{c}$

[1 mark]