Leaving Cert Exam Paper and Test Questions

1. Explain the difference between *Transverse* and *Longitudinal* waves. [2005]

2. [2003]
   A bat emits a wave of frequency 68 kHz and wavelength 5.0 mm towards the wall of a cave. It detects the reflected wave 20 ms later.
   Calculate the speed of the wave and the distance of the bat from the wall.

3. Define (i) *Diffraction* and (ii) *Interference.*

4. Why does diffraction not occur when light passes through a window? [2008]

5. A sound wave is diffracted as it passes through a doorway but a light wave is not. Explain why. [2006]

6. When a wave travels from one medium which of the following change and which stay the same?
   Velocity, Frequency, Wavelength

7. [2002]
   "Constructive interference and destructive interference take place when waves from two coherent sources meet."
   Explain the underlined terms in the above statement.

8. What is the condition necessary for destructive interference to take place when waves from two coherent sources meet? [2002]

9. Waves on a rope travel at a speed of 5 ms^{-1}. When *a stationary wave* is set up on the rope the distance between a node and its nearest anti-node is 70 cm. What is the frequency of the wave?

10. What is the Doppler Effect? [2008] [2007] [2006] [2003] [2002]

11. Explain with the aid of labelled diagrams how the Doppler Effect occurs. [2007] [2003]

12. Give two applications of the Doppler Effect. [2008] [2003]

13. It is noticed that the frequency of the received radio signal coming from a satellite changes as the satellite orbits Saturn.
    Explain why. [2005]

14. A police car travelling at 30 m/s passes a stationary observer. Its siren emits a tone of 1 kHz. If the velocity of sound is 336 m/s, what is the frequency heard by the observer when the car is approaching the observer?

15. A rally car travelling at 55 m s^{-1} approaches a stationary observer. As the car passes, its engine is emitting a note with a pitch of 1520 Hz. What is the change in pitch observed as the car moves away? [2008]

16. [2003]
    A bat emits a wave of frequency 68 kHz and wavelength 5.0 mm towards the wall of a cave.
    It detects the reflected wave 20 ms later.
    If the frequency of the reflected wave is 70 kHz, what is the speed of the bat towards the wall?

17. [2007]

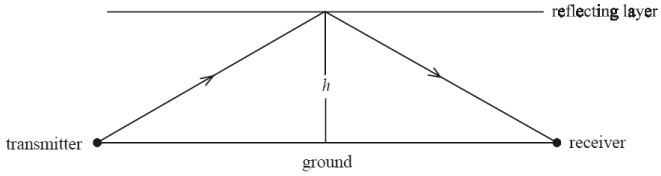
The red line emitted by a hydrogen discharge tube in the laboratory has a wavelength of 656 nm.
The same red line in the hydrogen spectrum of a moving star has a wavelength of 720 nm.

(i) Is the star approaching the earth? Justify your answer.

(ii) Calculate the frequency of the red line in the star's spectrum.

(iii) Calculate the speed of the moving star.

18. [2002] This was a particularly difficult question but is included here for completeness.
Radio waves of frequency 30 kHz are received at a location 1500 km from a transmitter.
The radio reception temporarily "fades" due to destructive interference between the waves travelling parallel to the ground and the waves reflected from a layer (ionosphere) of the earth's atmosphere, as indicated in the diagram.



(i) Calculate the wavelength of the radio waves.

(ii) What is the minimum distance that the reflected waves should travel for destructive interference to occur at the receiver?

(iii) The layer at which the waves are reflected is at a height h above the ground. Calculate the minimum height of this layer for destructive interference to occur at the receiver.

(speed of light, $c = 3.0 \times 10^{8}\ ms^{-1}$)