Name- **9 Adv Physics**

HOTS Numerical Challenges

1. The Lightning-Temperature Correlation

A hiker sees a lightning bolt and hears the thunder exactly **6.5 seconds** later. If the air temperature is **35°C**, calculate the distance of the hiker from the lightning strike.

(Note: Use the formula $v = 331 + 0.6T$ to find the speed of sound in m/s where T is temperature in Celsius).

2. The Sonar Depth Analysis

A research vessel sends a sonar pulse to the ocean floor. The pulse is reflected and received back at the ship after **4.8 seconds**. If the speed of sound in seawater is **1,530 m/s**, what is the depth of the ocean at that point in **kilometers**?

3. The Dual-Medium Race

A long steel pipe is struck at one end. A listener at the other end hears two distinct sounds: one traveling through the steel and one through the air. The pipe is **1.5 km** long.

- Speed of sound in air = **340 m/s**
- Speed of sound in steel = **5,900 m/s**

Calculate the **time interval** between the two sounds reaching the listener.

4. The Echo and the Moving Target

A driver honks their horn while driving toward a large vertical cliff at a constant speed of **20 m/s**. If the driver hears the echo **3 seconds** later, how far was the car from the cliff at the **moment the horn was honking**?

(Assume the speed of sound is 340 m/s).

5. The Frequency-Wavelength Shift

A tuning fork produces a sound with a frequency of **512 Hz**. This sound travels from air (where the speed is **340 m/s**) into a pool of water (where the speed is **1,480 m/s**).

- Calculate the wavelength of the sound in the air.
- Calculate the wavelength of the sound in the water.