The Doppler Effect and The Decibel Scale Problems

Doppler Problems: (Use 340 m/s for the speed of sound)

1. A model airplane whose engine is turning at 8550 RPM (revolutions/minute) flies overhead at 25.0 m/s. What frequency of the engine (in hertz) will an observer hear as the plane approaches? (Assume the sound produced has the same frequency as the engine.)

2. An electronic buzzer with a natural frequency of exactly 1000 Hz is swung in uniform circular motion on the end of a 2.00 meter long cord at the rate of exactly 1.00 revolutions per second.
    a. What is the linear speed of the buzzer?

    b. What frequency will a listener seated directly beside its path hear as the buzzer approaches?

    c. What frequency will be heard as the buzzer moves away?

    d. What change in frequency will be heard?

3. A train approaches a crossing while sounding its horn, which has a natural frequency of 860 Hz. A physics student in a car, stopped for the train has an app for her Iphone that can measure sound frequencies and measures the frequency as 880 Hz. How fast is the train moving?

The Decibel Scale Problems

1. What is the ratio of actual sound intensity of a city street compared to an average conversation? How much more actual sound intensity (in W/m^2) is present in the sound of a city street compared to average conversation?

2. A jet plane is found to have an intensity-level upon takeoff of 120 dB. Calculate the actual intensity of the sound (in W/m^2) the jet makes.

3. Calculate:
    a. The intensity of the sound (in W/m^2) produced by a 50.0 W stereo system at a distance of 2.85 m from the stereo.

    b. The intensity-level in decibels.

4. The actual intensity of a sound is tripled. By how many decibels does it increase?

Large rocket	180	Heavy Truck	90	Average conversation	60
Jet engine	140	City street	80	Living room (city)	40
Rock concert	120	Loud music	80	Bedroom	30
Air hammer	110	Freeway traffic	75	Library	30
Shout	100	Toilet flushing	67	Whisper	20
Car horn	95	Noisy store	60	Cat purring	15