Tutorial No 1, Semester 2, 2024/25

1. Two trees next to each other are swaying repeatedly left to right during a strong wind. The shorter tree, a mango tree, completes 12 cycles during the same period of time during which the taller tree, a coconut tree, completes 9 cycles. If the coconut tree completes 6 full cycles in 5 seconds, calculate the frequencies of vibration for each of these two trees. When the wind gets weaker, the frequency of the coconut tree decreases to 1 Hz, and the frequency of the mango tree decreases by the same proportion. What is the frequency of the mango tree when the wind gets weaker?

2. A little boy strolling in a park sings a note with a frequency of 1,024 Hz. If a bassoon player relaxing nearby in the park then plays a note which is 4 octaves below the note from the little boy, what is the frequency of the bassoon's note? A flute player standing nearby then plays a note on her flute which has a frequency of 512 Hz. What is the number of octaves between the flute's note and the bassoon's note? A bass singer not too far away then sings a note which is 2 octaves below the flute's note. What is its frequency and the number of octaves this note is above the bassoon's note? If the frequency of the boy's note is 1,760 Hz instead of 1,024 Hz, what would be the frequencies of the bassoon's note, the

flute's note and the bass singer's note, if these notes maintained the same frequency relationships to each other as before?

3. The siren of a fire engine passing right in front of you registers a sound level of 98 dB on a sound level meter you are carrying. When the fire engine stops at a house on fire some distance away, the sound from its siren is 100 times weaker than when it was in front of you. What would the reading be on your sound level meter due to the siren? After the fire engine turns off its siren, the siren of a police car at the location of the fire registers a reading of 68 dB on your sound level meter. How much less or more powerful is the sound from the police car's siren compared to the siren of the fire engine? (Assume that the reading on the sound level meter is due only to the sound of the fire engine's siren or the police car's siren.)

4. A sonata for solo flute starts with a time signature of 28/8. A certain bar in this sonata begins with four dotted quavers and ends with a minim. How many semiquaver notes could fit into the middle of this bar in order to correspond exactly with the time signature? If the end of the bar had two dotted crotchets instead of one minim, how many semiquavers would then fit exactly into the middle of the bar? (If we add a dot to a note or a rest, the duration of the note or rest is increased by 50%.)

5. Starting from any key on a piano keyboard and going up or down to a key which is its immediate neigh-

bour, the interval moved is always the interval of a semitone. Starting from any key to the next key above or below which has the same letter name (i.e. A, B, C, etc), the interval moved is always 12 semitones or one octave. If we start from the piano key with the letter name of G just below Middle C, how many semitones are there from this G to the A which is just above Middle C, and what is this interval in terms of octaves? What is the letter name of the piano key which is the same number of semitones below the starting G? Give the number of octaves from this lower note to the A just above Middle C.

6. We define the ratio of a musical interval from one musical note to another musical note at a higher pitch as the ratio of the frequency of the higher note to the frequency of the lower note. If we start from a note with a frequency of 256 Hz and move up by an interval with a ratio of $\frac{13}{8}$, calculate the frequency of the higher note on which we will arrive. Starting from this second note and going down by an interval with a ratio of $\frac{16}{11}$, calculate the frequency of the third note on which we will arrive. What is the ratio of the interval between the first note and the third note?

Scientific Inquiry discussion points

1. Science seeks to discover and understand the universe through the methodology of scientific inquiry. Scientists observe the universe and formulate hypotheses to explain what they observe. They test their hypotheses through experiments and further observation. A

hypothesis becomes an accepted theory if supported strongly by experimental or observational evidence. Can you think of examples of scientific inquiry which changed our perception and understanding of the universe?

2. Technology seeks to shape and modify the universe in order to improve the quality of life in human society. Technology can include simple objects like chairs and lamps, and complex objects like computers and integrated circuits. Like science, technology dates back to the earliest days of mankind, and technological tools and artefacts can be found in the earliest archeological sites. What are good examples of technological achievements in early societies and in modern civilisation?