Tutorial No 1, Semester 2, 2025/26

1. Two flagpoles next to each other are swaying repeatedly from left to right during a strong wind, and the shorter flagpole completes 9 cycles in the same period of time during which the taller flagpole completes 8 cycles. If the taller pole completes 4 full cycles in 5 seconds, what are the frequencies of vibration for each of these two flagpoles? When the wind gets even stronger, the frequency of the taller flagpole increases to 1.08 Hz, and the frequency of the shorter flagpole increases by the same proportion. Calculate the frequency of the shorter flagpole when the storm gets stronger.

2. A woman who is taking a walk in a park sings a note with a frequency of 880 Hz, and a bassoon player sitting nearby in the park then plays a note which is 4 octaves below the woman's note. Calculate the frequency of the bassoon's note. If a tenor singer standing a short distance away then sings a note which has a frequency of 220 Hz, what is the number of octaves between the tenor singer's note and the bassoon's note? A flute player standing nearby then plays a note which is 5 octaves above the bassoon's note. Calculate the frequency of the flute's note and the number of octaves this note is above the tenor singer's note. If the frequency of the woman's note is 1,000 Hz instead of 880 Hz, calculate the frequen-

cies of the bassoon's note, the tenor singer's note and the flute's note, if these notes maintained the same frequency relationships to each other as before.

3. The first item at a concert which you are attending is a choir which registers 88 dB on a sound level meter which you are holding. The next item is a clarinet solo which is much softer and produces a reading of 58 dB on your sound level meter. How much less is the sound power of the clarinet compared with that of the choir? After the clarinet item, a jazz band performs with a sound power reaching your sound level meter 10,000 times greater than that of the clarinet. What would you expect the reading on your sound level meter due to the jazz band to be?

4. A solo oboe is to perform a piece of music which begins with a time signature of 20/8. One particular bar in this piece begins with three dotted quavers and ends with two quavers and a dotted crotchet. How many semiquaver notes could fit into the middle of this bar in order to correspond exactly with the time signature? If the bar begins with three quavers instead of three dotted quavers, 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 neighbour, the interval moved is always that of a semitone. Therefore 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 E just below Middle C, how many semitones are there from this E to the D which is just above Middle C? Express 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 E? Calculate the number of octaves from this lower note to the D 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 240 Hz and move up by an interval with a ratio of $\frac{17}{10}$, what is the frequency of the higher note on which we will arrive? If we start from this second note and go 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?