Tutorial No 1, Semester 1, 2024/25

1. Two flagpoles of different lengths are next to each other and are swaying repeatedly back and forth during a storm. The shorter flagpole completes 9 cycles during the same period of time during which the longer flagpole completes 6 cycles. If the longer flagpole completes 8 full cycles in 5 seconds, what are the frequencies of vibration for each of these two flagpoles? When the storm gets stronger, the frequency of the longer flagpole increases to 2.8 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 young girl walking in a park sings a note with a frequency of 1,760 Hz. A tuba player who is passing by then plays a note which is 5 octaves below the note from the girl. Calculate the frequency of the tuba's note. If a clarinet player walking nearby then plays a note on her clarinet which has a frequency of 220 Hz, what is the number of octaves between the clarinet's note and the tuba's note? If a singer waiting not far away then sings a note which is 2 octaves above the clarinet's note, what is its frequency and the number of octaves this note is above the tuba's note? If the girl's note is 1,320 Hz instead of 1,760 Hz, calculate the frequencies of the tuba's note, the clarinet's note and the singer's note, assuming that

these notes maintain the same relationships to each other as before.

3. A brass band's performance is the first item in a community centre concert which you attended. You notice that it registers 94 dB on a sound level meter which you are carrying. The next group to perform is a children's choir made up of very young boys and girls. If the sound reaching you from the choir is 1,000 times less powerful compared to that from the brass band, what would the reading on your sound level meter be due to the choir? A string quartet which is the third group performing registers a reading of 74 dB on your sound level meter. Calculate how much less sound power is reaching you from the string quartet compared to the brass band. (Assume that the reading on the sound level meter is due only to the sound of the brass band, the children's choir and the string quartet.)

4. A piece for solo violin begins with a time signature of 23/8, and one particular bar in this score begins with three quavers and ends with a dotted crotchet. What is the number of semiquaver notes which could fit exactly into the middle of this bar in order to correspond exactly with the time signature? If the end of the bar had four crotchets instead of one dotted crotchet, how many semiquavers which would 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. If we were to start from any key on a piano keyboard

and go up or down to a key which is its immediate neighbour, this move is always by the interval of a semitone. If we start from any key to the next key above or below which has the same letter name (i.e. A, B, C, etc), that interval moved is always by 12 semitones or one octave. Starting from the piano key with the letter name of A just above Middle C, how many semitones are there from this A to the B which is just below Middle C? What is this interval in terms of octaves? Find out the letter name of the piano key which is the same number of semitones above the starting A. What is the number of octaves from this higher note to the B just below Middle C?

6. The ratio of a musical interval from one musical note to another musical note at a higher pitch is defined as the ratio of the frequency of the higher note to the frequency of the lower note. Starting from a note with a frequency of 320 Hz and moving down by an interval with a ratio of $\frac{16}{7}$, what is the frequency of the lower note on which we will arrive? Starting from this second note and going up by an interval with a ratio of $\frac{13}{4}$, what is the frequency of the third note on which we will arrive? Calculate 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?