Chapters 1.4 , 2.4 and 1.11

Length, Mass Capacity. Time and Travel Graphs

Chapter Objectives:

- Know suitable units needed to solve problems used in everyday contexts;
- Know relationships between metric units and how to convert between these units;
- Know how to convert between 12 hour clocks and 24 hour clock readings;
- Know how to read scales from analogue or digital instruments;
- Know how to sketch and read linear distance time graphs and how to calculate the speed from such graphs

4.1 The Metric system:

Units which measure lengths are:

meter (1 m -- fundamental unit),

decameter (1 dam= 10 m) , hectometer (1 hm= 100 m), Kilometer (1 Km = 1000 m)

decimeter (1 dm = 0.1 m), centimeter (1 cm =0.01 m) and millimeter (1 mm = 0.001 m)

Units of mass are:

Kilogram (1 Kg -- fundamental unit)

gram (1 g = 0.001 Kg) and milligram (1 mg = 0.001 g)

Units of capacity (used to measure quantities of liquids) are:

Liter (1 L – fundamental unit)

Milliliter (1 ml = 0.001 l)

Examples:

Do Ex 4.1 A (Book 1): 1, 2 and Ex 4.1 B (Book 1) : 1, 5, 6

Do Ex 4.1 A (Book 2): 1 and Ex 4.1 B (Book 2): 1 and 2 (as Homework Bonus)

4.2 Reading Scales:

The most important rule when reading scales is to calculate first the value of each division (or the unit) of the scale.

Example: See the two scales on page 37 (Book 1) :

scale 1: $\text{unit}=\frac{50}{5}=10$ and scale 2: $\text{unit}=\frac{10-5}{10}=0.5$ (be careful here, as this scale does not start at 0).

then from Ex. 4.2 A (Book 1) : 1, 2, 3, 4, 5 and 6 and from Ex 4.2 B (Book 1): 1, 2, 3 and 5.

4.3 Time (Chapter 11, Book 1):

The fundamental unit of measure of time is 1 hour (1 h).

Other units of time: day: 24 hours = 1 day
minute (min) : 60 minutes = 1 hour .
second (sec) : 60 seconds = 1 minute

There are two ways to indicate a specific time of the day: the 12 – hour clock and the 24 – hour clock . The 12 hour clock uses a.m. for hours in the morning (12 a.m. – midnight to 12. p.m. – midday) and p.m. for hours in the afternoon (12 p.m. – midday to 12 a.m. – midnight) .

With the 24 hours clock, times from 00 00 to 12 00 refer to morning, and times from 12 00 to 24 00 refer to afternoon.

Example:

- On the worked example on page 94 (Book 1):
  a) Change the following times to 24 hour clock times:
     i) 5 a.m.= ii) 9 p.m. = ii) 8.35 p.m. =
  b) Change the following 24 hour times to 12 hour clock times:
     i) 07 30 = ii) 16 20 = iii) 23 45 =
- Then do Exercise 11.1 A (Book 1) : 1, 5 and 6 and Exercise 11.1 B (Book 1): 1, 2, 3 and 5 .

4.4 Travel Graphs:

The motion of an object can be displayed on a distance – time graph (which shows the position of the object at different times) , which is also called a travel graph.

An object travelling at a constant speed has a linear distance time graph, and conversely, if an object has a linear distance time graph, then that object travels with constant speed.

This is because the speed of the object with a linear distance – time graph (over some time interval $[t_A, t_B]$ is : $\mathrm{v}_{AB} = \dfrac{\text{distance over [AB]}}{t_B - t_A} = \dfrac{x_B - x_A}{t_B - t_A}$, which represents the slope of the linear distance time graph, and this is constant (it does not depend on the choice of the time interval $[t_A, t_B]$) : See for example the Figure on page 96 (Book 1) for an example of a linear distance – time graph and calculate the speed of the object for this graph.

Examples:

1. **From Exercise set 4.3 (Book 2):**
   Exercise 1: Answers : a) 7.30 a.m. b) 10 a.m. c) 10.30 a.m.
   d) $\text{speed}_{\text{A}} = \dfrac{7 \text{ Km}}{3 \text{ hrs}} = \dfrac{7}{3} \text{Km / hr} = 2.\bar{3} \text{ Km / hr}$
   e) $\text{speed}_B = \dfrac{3 \text{ Km}}{1/2 \text{ hrs}} = 6 \text{ Km / hr}$
   f) Person A, since the line has a higher slope (gradient)

2. From Exercise set 4.3 (Book 2) do exercise 2 , 3 and 4 and then:

3. Do Ex 11.2 A (Book 1).

In this example:

Speed= $\dfrac{80 \text{ meters}}{10 \text{ secs}} = 8 \text{ m / sec}$

1) How long does the object takes to travel 50 m: from the graph it appears that time=6 sec .
   A more precise calculation is: $\text{speed} = \dfrac{\text{d}}{\text{t}} \rightarrow t = \dfrac{d}{\text{speed}} = \dfrac{50}{8} = \dfrac{25}{4} = 6.25 \text{ secs}$

4. Similarly, solve parts 2-10 of this exercise, and Exercise sets 11.2 C and 11.2.D.