6.1.1 Circular Motion

(Note: for the following section, you need to understand the difference between speed and velocity and distance and displacement. If you don't recall, do a bit of research to answer the following questions.)

(1) What sort of quantities are speed & distance, and velocity & displacement?

(2) Explain what the difference is between these two types of quantity.

Uniform Circular Motion

Uniform circular motion is motion where an object moves with constant speed (v) in a circle. This means that the time for one complete cycle (the period) is a constant. The speed is just the circumference (distance moved in one cycle) divided by the period (the time taken for one cycle).

$$v = \frac{2\pi r}{T}$$

where r is the radius of the circle.

The period (T) is related to the frequency (f):

$$T = \frac{1}{f}$$

(3) Write down the relationship between v and f by substituting for period?

(4) The speed remains constant, but the velocity doesn't. Explain why.

(5) The distance moved in one complete cycle is $2\pi r$. The displacement is zero. Explain this.

(Note: for the next section, you will need to have an understanding of radians. You will need to know how to convert between radians and degrees. You will need to look this up, if you are unsure.)

Angular speed

As the name suggests, the angular speed (ω) is the angle passed through per second. The units for angular speed are degrees per second or radians per second ($rad\ s^{-1}$).

(6)✎ Explain the benefits of using angular speed over linear speed when objects are in circular motion. (You will need to look carefully at the expression for linear speed)

(7)✎ What would the angular speed be if the object undergoing circular motion completes 2 cycles in 1 second? Answer in degrees per second and rad s^{-1}. (Note: remember one full circle is 2π radians)

Angular displacement

Angular displacement (θ) is the angle passed through in a given time, *t*.

[If an object moves with a velocity of $0.5ms^{-1}$ east. Its displacement after a time of 10s is 10 x 0.5 = 5m east. In general displacement ***s = ut***, where *u* is the velocity and *t* is the time.]

(8)✎ Write an expression relating angular displacement to angular speed.

(9)✎ How is angular displacement related to distance moved by object?

(10)✎ Show how you can link your equations to get an expression that relates linear speed and angular speed