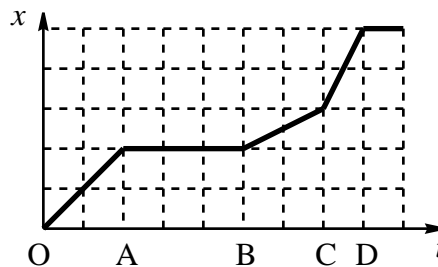


Part I

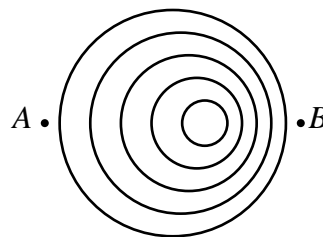
1. A kangaroo jumps straight into the air. During the time the kangaroo is in the air its velocity
 - (a) is constant
 - (b) is decreasing
 - (c) first increases then decreases.
 - (d) first decreases then increases.
2. Which one of the following choices is correct in the case of uniformly accelerated motion?
 - (a) Distance increases at the same rate as time.
 - (b) Velocity increases at the same rate as time.
 - (c) Acceleration increases at the same rate as time.
 - (d) Force increases at the same rate as time.
3. The motion of a particle is described by the position-time graph shown below. During which interval is the *instantaneous* velocity of the particle greatest?



- (a) OA
 - (b) AB
 - (c) BC
 - (d) CD
4. For the above position-time graph during which interval is the *average* velocity greatest.
 - (a) OA
 - (b) OB
 - (c) OC
 - (d) OD
 5. A string which is fixed at both ends vibrates at its fundamental frequency. The tension of the string is now increased and the string is again made to vibrate at its fundamental frequency. Which one of the following statements about the change in the properties of the wave is correct
 - (a) The wave speed increases and the wavelength increases.
 - (b) The wave speed increases and the frequency increases.
 - (c) The wave speed decreases and the wavelength decreases.
 - (d) The wave speed decreases and the frequency decreases.

6. Two observers A and B listen to sound from a moving source. The diagram on the right shows the wave fronts of crest of a wave. Which of the following statements is true

- (a) The wavefronts move faster at A than at B
- (b) The wavefronts move faster at B than at A
- (c) The frequency of the sound is highest at A
- (d) The frequency of the sound is highest at B



7. A double slit is illuminated with yellow light. The pattern seen on a screen behind the slits consists of three yellow spots, one straight through ahead and one each at an angle of $\pm 45^\circ$ on either side of this. You now add red light of equal intensity, coming in the same direction as the yellow light. The new pattern consists of

- (a) red spots at 0° and $\pm 45^\circ$
- (b) orange spots at 0° and $\pm 45^\circ$
- (c) an orange spot at 0° , yellow spots at $\pm 45^\circ$, and red spots slightly farther out.
- (d) an orange spot at 0° , yellow spots at $\pm 45^\circ$, and red spots slightly closer in.

Part II

1. Sketch graphs of position vs time, velocity vs time, and acceleration vs time for each of the following situations.

- (a) A car moving with uniform motion in the negative direction.

- (b) A ball thrown upwards in the positive direction which rises and returns to the ground.

2. A spring with a mass hanging at rest on the end is 12 cm in length. The mass is pulled down until the spring is 15 cm in length and is then released. The spring oscillates with frequency 0.5 Hz.

(a) What are the amplitude and period of the oscillations?

(b) Sketch a graph of the length of the spring in cm as a function of time in seconds since it was released.

(c) Write down a mathematical model for the oscillations of the spring in the form

$$y = a \cos(bt) + c.$$

3. A guitar string of length 80 cm oscillates in its fundamental mode with a frequency of 440 Hz.

(a) Describe how standing waves in a string are formed.

(b) Draw pictures showing the shape of the modes of vibration for the first three harmonics and indicate the value of their wavelengths.

(c) What would be the speed of a wave traveling down this string.

- (d) An identical string but at a different tension vibrates at 444 Hz
- (i) If both strings vibrate together beats are heard. Describe what beats are and how they are formed.

(ii) What is the frequency of the beats?

4. Monochromatic source of light (ie light of only one frequency) illuminates a screen. Two very narrow parallel slits 0.5 mm apart are placed between the source and the screen at a distance of two metres from the screen. Interference fringes are obtained.

(a) If the spacing between five fringes is 10 mm calculate the wavelength of the light.

(b) What will be the effect on the fringes of

(i) halving the distance between the double slit and the screen;

ii) halving the slit separation;

iii) covering one of the double slits;

(iv) using white light.