

# Higher Physics Masterclass 5



- 1) A small experimental rocket mounted on a track accelerates from rest to  $20 \text{ ms}^{-1}$  in 0.4 seconds.



- a) Calculate the acceleration of the rocket.  
b) Determine the distance the rocket reached along the track after 0.4 s.
- 2) Sound of frequency 512 Hz is generated by a hooter on top of an express train. The express train travels away from an observer with a speed of  $80 \text{ m s}^{-1}$



- a) Calculate the frequency heard by an observer as the train moves away from him.  
b) When the frequency of sound is doubled it is said to go up by an octave. Determine the speed the train must have to raise the hooter's frequency by an octave. State the direction the express train must be moving in relation to the observer for this increase in frequency to occur.

- 3) Light from a distant galaxy is said to be redshifted. Explain the term '**redshifted**'.

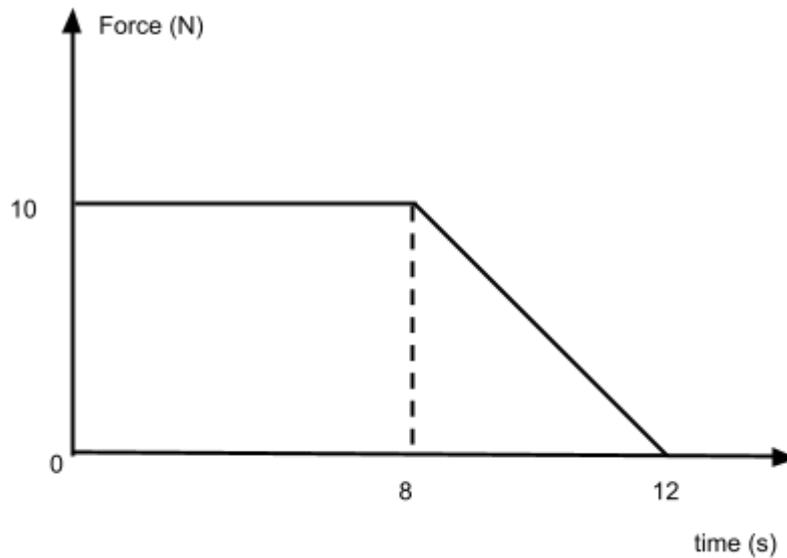
- 4) A spacecraft in the 23rd century leaves Earth with a velocity of  $0.95 c$  relative to the Earth. The clock on the spaceship registers a journey time to a distant galaxy as 5 years. Determine the time of the journey as recorded from an observer on Earth.



- 5) A 20 kg package is placed on a set of newton scales on the floor of a lift. The lift accelerates upwards at  $1.5 \text{ m s}^{-2}$ . Determine the reading on the scales as the lift is accelerating upwards.

- 6) A  $2200 \mu\text{F}$  capacitor is charged so that the pd across its plates is  $12 \text{ V}$ . Calculate the energy stored in the capacitor.

- 7) Determine from the following force time graph the change in the object's momentum.



- 8) The asteroid *Geographus* has a mass of  $4.0 \times 10^{12} \text{ kg}$ . The mean distance between the centres of the Earth and the asteroid is  $1.2$  astronomical units. Find the gravitational force of attraction the asteroid has on the Earth.

[  $1 \text{ astronomical unit} = 1.5 \times 10^8 \text{ km}$  Earth's mass =  $6.0 \times 10^{25} \text{ kg}$  ]

- 9) Calculate the pd across points A and B in the circuit shown below with

- a) switch S open  
b) switch S closed

