

# SPH3UI Exam Review

(Thurs Jun 20)



# Key Concepts

## ■ Kinematics

- d-t, v-t, a-t graphs
- Big 5 equations
- Chase problems

## ■ Dynamics

- free body diagrams
- Newton's three laws and application
- Universal Gravitation
- Friction – static and kinetic

# Key Concepts

- Energy Work and Power
  - work / energy relationship
  - gravitational potential energy and kinetic energy
  - conservation of energy
  - thermal energy (incl. heating diagrams)
- Waves and Sound
  - universal wave equation
  - reflection and interference
  - air columns
  - speed of sound
  - Doppler effect

# Key Concepts

- Electricity and Magnetism
  - Ohm's Law
  - series vs parallel circuits
  - theory of electromagnetism (right hand rule)
  - electric motor vs generator

# Crib Sheet

- 8 1/2 x 11 page
- handwritten
- no diagrams
- no pre-written examples
- no definitions
- formulas including variable definitions are allowed (titles also allowed)
- **MUST BE HANDED IN WITH EXAM**

Universal Wave Equation

$$V = f\lambda$$

$\lambda$  - wavelength  
 $V$  = velocity  
 $f$  = frequency

Air Columns

open ended  
 $L = \frac{1}{2}\lambda, 1\lambda, 1\frac{1}{2}\lambda$  etc  
 $L$  = length of column

closed ended  
 $L = \frac{1}{4}\lambda, \frac{3}{4}\lambda, \frac{5}{4}\lambda$  etc

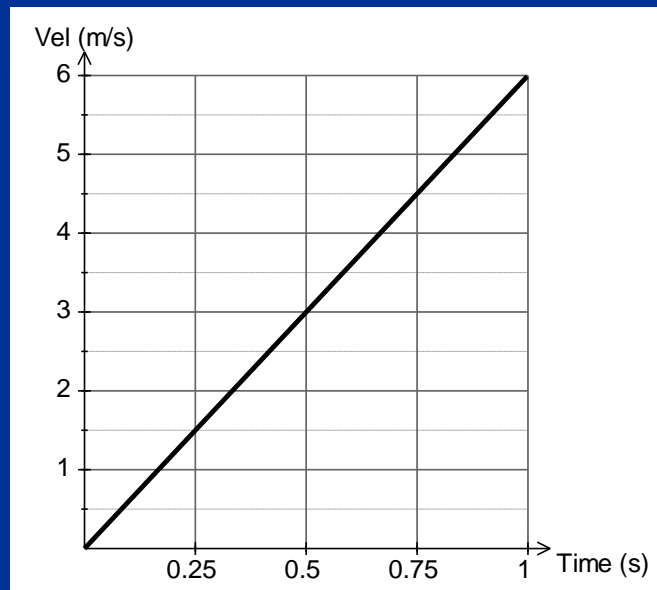
**... IF IN DOUBT ASK....**

# SPH3UI Exam Review Questions



# Question #1 : Kinematics

A sprinter in a 100 m dash has a velocity-time profile for the first second of the race as shown below:



Determine the sprinters position-time graph (at  $t=0$ , .25, .5, .75 and 1.0 secs) and average acceleration

# Question #2 : Kinematics

- A Rocket is travelling at  $100 \text{ m/s}$  when it fires its engines generating an average acceleration of  $2.0 \text{ m/s}^2$ . While accelerating the rocket travels  $20 \text{ km}$ .
  - a. How long does it take for the rocket to travel this  $20\text{km}$ ?
  - b. How fast is the rocket going at the end of this acceleration period?



# Question #3 : Kinematics

- The tortoise and hare are having a 300m race. The hare gives the tortoise a 225m headstart and the tortoise travels at a constant velocity of 0.5 m/s.

Assuming the hare accelerates uniformly from rest at  $0.2 \text{ m/s}^2$ , does the hare pass the tortoise before the finish line and if so where?



# Question #4 : Dynamics

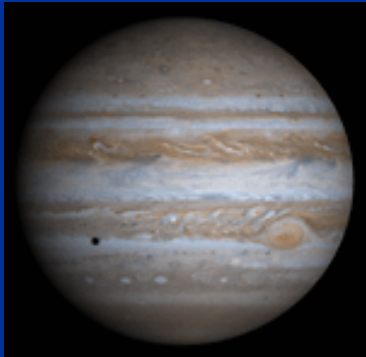
You are attempting to push your car (that has run out of gas) on a flat stretch of road. The coefficient of static friction is 0.80 and coefficient of kinetic friction is 0.60. If the car has a mass of 1500 kg.

- a. What is the minimum force you must apply to start the car moving?
- b. What is the amount of force that you must push with to keep it moving?

# Question #5 : Dynamics

Jupiter is the largest planet in the Solar System with a mass of  $1.899 \times 10^{27} \text{ kg}$  and a radius of  $7.149 \times 10^7 \text{ m}$ . What would be the force of gravity on a 1 kg object on the surface of Jupiter?

Compare this to the force on the same object on the surface of the earth.

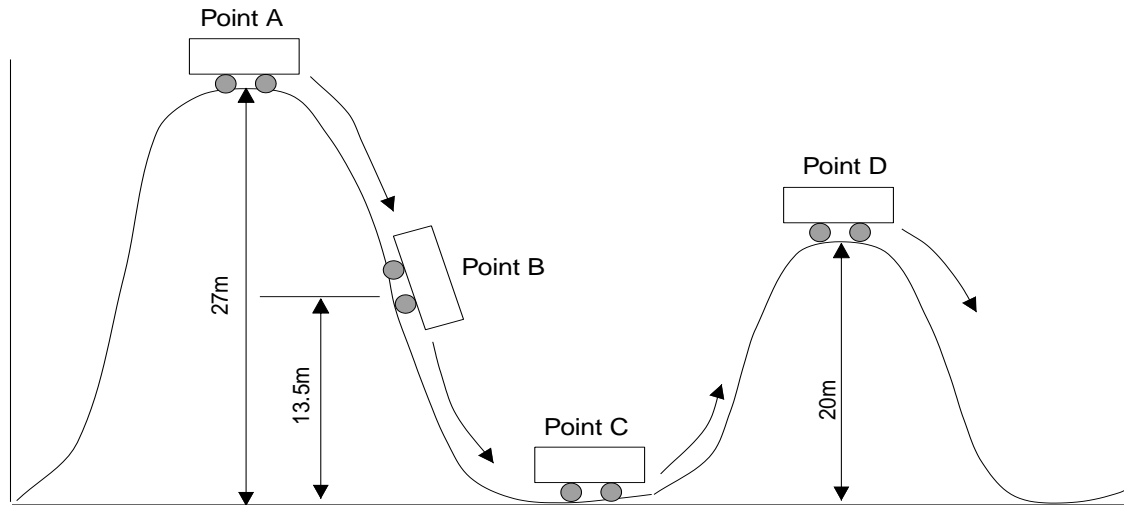


# Question #6

## Energy, Work and Power

The average mass of the coaster car is 1,000kg (including passengers). Assuming zero kinetic energy at the top of the ride calculate the following:

- If it took 20 seconds to pull the coaster to the top what Power was needed by the motor to lift the coaster?
- What would the speed of the coaster be at point D?



# Question #7

## Energy, Work and Power

Draw a heating diagram and calculate the energy required to melt 2.0kg of ice initially at  $-30^{\circ}\text{C}$  and warm it up to  $85^{\circ}\text{C}$ .

specific heat capacity ice	2,100 J/kg $^{\circ}\text{C}$
latent heat of fusion	334,000 J/kg
specific heat capacity water	4,180 J/kg $^{\circ}\text{C}$
latent heat of vaporization	2,260,000 J/kg
specific heat capacity water vapour	2,100 J/kg $^{\circ}\text{C}$

# Question #8 : Waves and Sound

A monarch butterfly beats her wings at a frequency of 9Hz. If the amplitude of the wings motion is 1.5cm, calculate how far the wings move in one minute.



# Question #9 : Waves and Sound

A closed ended air column is 120 cm long. What are the wavelengths of the first 3 resonant waves?

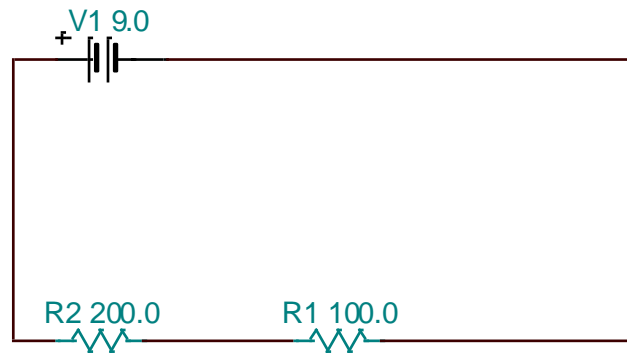
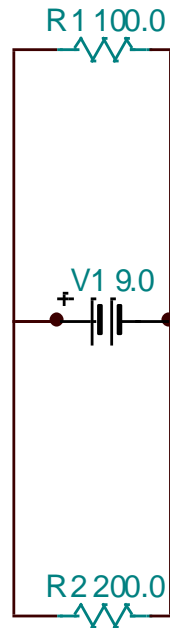
If the air temperature is  $20^{\circ}\text{C}$ , what is the frequency of these three waves?



# Question #10

## Electricity and Magnetism

Characterize the following circuits (find all the missing voltages, currents and overall power used and show the direction of the current(s)).





# Question #11

## Electricity and Magnetism

State the three main components of an electric motor.

What is the key difference between an electric generator and an electric motor?

Show the direction of the magnetic field for the following current carrying conductors.

