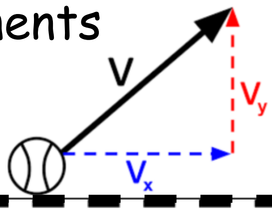
How do you calculate the horizontal and vertical components of a vector ?



1

Write down the quantities and units for the equations

$v = u + at$

$s = ut + 1/2at^2$

$v^2 = u^2 + 2as$

2

What do we get if we calculate the gradient or area of a velocity time graph?

3

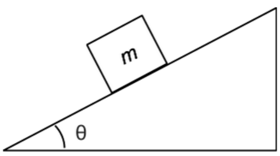
State Newton's First, Second and Third Laws of Motion

4

What do we mean by the phrase Conservation of Energy?

5

How do you work out the component of weight acting down a slope?



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What is the law of conservation of momentum

7

What is meant by the terms elastic and inelastic collisions ?

8

What are three ways to find impulse?

9

Explain the equation $Ft = mv - mu$

10

s is displacement (m)
u is initial velocity (ms^{-1})
v is final velocity (ms^{-1})
a is acceleration (ms^{-2})
t is time (s)

$V_h = V \cos \theta$

$V_v = V \sin \theta$

NI – If the forces on an object are balanced the objects velocity remains constant.
NII – If there is an unbalanced force then the object accelerates.
NIII – For every action force there is an equal size but opposite direction force.

Gradient calculates the acceleration.
Area calculates the displacement.

Component of weight down slope

$= mg \sin \theta$

Energy is not created or destroyed it changes from one form to another

In an elastic collision both momentum and energy are conserved.
In an inelastic collision only momentum is conserved

In the absence of external forces the total momentum before a collision equals the total momentum after a collision.
$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Ft is the impulse
mv – mu is the change in momentum

Average force x time
or
Area under a force time graph
or
Change of momentum

Recognise the formulae for work done, kinetic energy, gravitational potential energy and power

11

Describe why projectiles follow a curved path

12

Describe & explain the motion of a satellite.

13

Newton's law of gravitation.

14

State the first basic postulate of Special Relativity.

15

State the second basic postulate of Special Relativity.

16

State the formula for Time Dilation

17

Give one example showing Time Dilation

18

What (simply put) is Time Dilation?

19

Give a second example showing Time Dilation

20

They have a constant horizontal velocity (ignoring air resistance) and a constant vertical acceleration due to the force of gravity (weight).

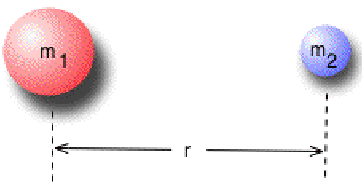
$E_w = Fd$

$E_k = \frac{1}{2} mv^2$

$E_p = mgh$

$P = E/t$

$$F = \frac{G m_1 m_2}{r^2}$$



F = The pull of gravity [N]
m1 = One object's mass [kg]
m2 = Other object's mass [kg]
r = distance between the object's
G = the universal constant(do not memorize it

$G = 6.67 \times 10^{-11}$ $(N \cdot m^2)/(kg^2)$

Satellites are in free fall around a planet or star. They have a constant horizontal velocity and a constant vertical acceleration.

The speed of light (in a vacuum) is the same for all observers.

Two observers moving at constant speed observe the SAME laws of Physics.

Fast moving cosmic muons reach the Earth's surface when, without Time Dilation, they would decay in the upper atmosphere.

$$t' = \frac{t}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Clocks on satellites e.g. GPS, run slow. Systems must take this into account if they wish to calculate an accurate position.

Moving clocks appear to run slow (to an outside observer).

State the formula for Length Contraction

21

What (simply put) is Length Contraction?

22

What is the Lorentz Factor?

23

Which Greek letter represents the Lorentz Factor?

24

What is the Time Dilation formula in terms of the Lorentz Factor?

25

What is Proper Time, t ?

26

What is Dilated Time, t' ?

27

What is Proper Length, l ?

28

What is Dilated Length, l' ?

29

What is the Doppler Effect?

30

Moving objects appear shortened (to an outside observer).

$$l' = l\sqrt{1 - \frac{v^2}{c^2}}$$

Gamma

γ

$$\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The time measured in a frame in which the clock is at rest relative to the event e.g. the clock actually on the spaceship. Time is always shorter in this frame.

$$t' = t\,\gamma$$

The length measured in a frame in which the measurer is at rest relative to the event e.g. the length actually measured on the spaceship. Length is always longer in this frame.

The time measured in a frame where you are observing the event from the outside e.g. on the planet watching the spaceship fly past. Time passes faster here. The moving clock seems to be running slow.

Observed change in frequency of a wave when the source is moving relative to the observer.

The length measured in a frame where you are observing the event from the outside e.g. on the planet watching the spaceship fly past. The moving object length is shorter.

Formula for the Doppler Effect for sound

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Doppler Effect - if the source is approaching, do you add or subtract the source velocity in the divisor? Why?

32

What is a Z value?

33

How do you calculate a Z value? Give **two** methods

34

What is Redshift?

35

What is Blueshift?

36

Formula for Hubble's Law

37

How is the age of the universe estimated from Hubble's Law?

38

What do measurements of galaxy velocities and their distance from us tell us about the universe?

39

How is the mass of a galaxy estimated?

40

Subtract the source velocity.
It makes the perceived frequency higher.

$$f_0 = f_s \left(\frac{v}{v \pm vs} \right)$$

V = Speed of sound
Vs = Speed of source
f_0 = Observed frequency
f_s = Source frequency

$$Z = \frac{\Delta\lambda}{\lambda_{rest}} = \frac{v}{c}$$

A measure of the red-shift of an object, given as a fraction of the speed of light.

Waves coming from a source moving towards an observer are measured to have a higher frequency (bluer) than the source

Waves coming from a source moving away from an observer are measured to have a lower frequency (redder) than the source

$$\frac{d}{v} = \frac{1}{H_0} =$$ age of the universe

$$V = H_0 d$$

V = Recessional velocity of a galaxy
H_o = Hubble's constant
d = distance to the galaxy

By measuring the orbital speed of stars within the galaxy

The universe is expanding

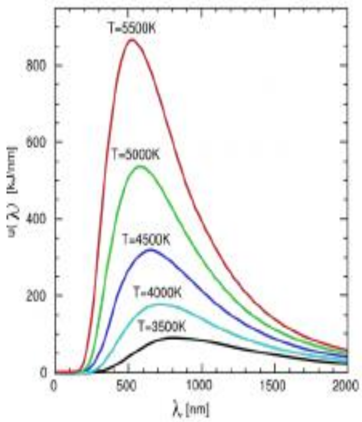
Give evidence for the existence of dark matter

41

Give evidence for the existence of dark energy

42

Describe the relationships between the temperature of a stellar object and the wavelength and irradiance of radiation emitted.



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Give evidence to support the Big Bang Theory

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The rate of expansion of the universe is increasing.

Stars in galaxies are orbitting faster than predicted.

Cosmic Microwave Background Radiation .
The abundance of hydrogen and helium.
The darkness of the sky (Olber's paradox).
Large number of galaxies showing redshift.

Peak wavelength is shorter for hotter objects.
Hot objects emit more radiation per unit surface area per unit time.

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