Vectors

Work = dot product of F and r = F\*r\*cos(theta)

Can calculate each work done by a force and sum or calculate total in 1 equation

Example

Floating ice block is pushed through a displacement, calculate work

D = 15i – 12j m

F = 210i – 150 N

W = F.D

= (210\*15)i + (-150\*-12)j

Example 2

A box sits on a frictionless ramp which is inclines, calculate work

M =20

Angle = 15

D = 20

F = 30

W = F.d cos(angle) = 30\*20 \* cos(15) = 600 \* cos(15) = 580J

If the same box is pulled at and angle of 70, how much work

W = 30\*20\*cos(70) = 205J

A unit vector is a dimensionless vector with a magnitude of 1, simply shows a direction

I = (1, 0, 0), j = (0, 1, 0), k = (0 ,0, 1)

The vector product

C = A cross B C = AxB

= (AyBz – AzBy)i – (AiBk - AkBi)j – (AiBy – AyBi)k

Example

A = 2i + j

B = 1i + 3k

a.b = 2 + 0 + 0 = 2

a x b = (1\*3 – 0\*0)I – (2\*3 -0x1)j – (2\*0 – 1\*1)k = 3i – 6j – 1k

# Thermo dynamics

Q = mct

Q = heat added (energy)

M = mass

T = change in temperature

C = specific heat

Isovolumetric process

V = constant

W = 0

Change in Internal energy = Q

All energy from heat remains as internal energy, when volume stays the same

Isobaric process

P = constant

Q and W generally both non zero

W = -P(vf - vi)

Adiabatic process

No heat transfer

Q = 0

Change in internal energy = W

Isothermal process

T = constant

Since no change in temp, Einternal = 0

Pv = constant

Q = -W

First law of thermodynamics

Eint = Q + W

If W > 0: volume decreases, internal energy increases

W < 0: internal Energy decreases

Q > 0: T increases

Q is heat added to the system

W is the work done on the system

PV = nRT

P = pressure

V = Volume

n = moles

R = constant = 8.617

T = temp