D)   **Friction** - force between 2 surfaces that oppose motion

          Depends on:
1)   _____of each surface

2)   _____ that holds objects together

Two kinds of friction

f_s 1)   **Stat**ic Friction - force of friction that must be overcome to move an object at _____.

f_k 2)   Kinetic Friction - force of friction that opposes a _____ object.

Kinetic friction is _____than static friction   fk _____ fs

Friction Equations
    To find static friction: **fs= us Fn**   To find kinetic friction: **fk = uk Fn**

fs = force of _____friction

fk = force of _____friction

Fn = _____force (The upward resisting force)

U**s** =   coefficient of _____friction - "the _____number"

U**k** =   coefficient of _____friction - "the _____number"

    1.   Relates to _____of surfaces in contact
    2.   Calculated experimentally

FRICTION force - vector always drawn **_____1**.

          Friction   Applied Force

    *** At **constant velocity**: F applied _____

***** When object is moving on a horizontal surface:** Fn = _____= _____

On a horizontal surface:

f s = _____   **f k** = _____

Question 1

If an object is moving on a horizontal surface and you **doubled the weight force** on the object, how would that change the **kinetic friction** force?

Answer - (Hint: **weight force** = **normal force** on **horizontal surface**.) _____

Question 2

On a horizontal surface

Static Friction equation   Kinetic friction equation

f s= **Fn** Us = _____   f k= Fn x Uk = _____

Look at the equations above.

1)   What would happen to the kinetic friction (fk) if:

a)   Uk (the roughness number) were halved?

Answer -

b) You doubled the weight force (F)?   Answer - _____

c) you turned the block on its' side?

FRICTIONAL PROBLEMS

***** Remember Fn = Weight = mg when the object is on horizontal surface

EX)   A 5kg Steel block is resting on a ***horizontal table***. The coefficient of static friction (Us) is 0.75 and the Uk is 0.57.

a)   What is the minimum force is needed to **start** this block moving (fs) ?

b)   What is the frictional force on this object as it ***moves?***

c)   What force must be applied to the object to keep it moving at **constant velocity**?

(Hint: F net = 0) Answer _____

Momentum - the property of moving object has that makes it _____.

   Momentum = _____ x _____

        p   =   _____
        (kg . m/s)

        a)   _____ quantity
        b)   p has same direction as _____
        c)   units - kg×m/s

1) Relationship between force and momentum

   When a **Force** acts on a body it changes its' _____

   Showing the mathematical relationship

   p = m x v   F = m x a

    = _____   F =   _____

   F = _____   Force is the time rate of change in _____

   Cross multiply and you get ……..   = _____

The change in momentum that an unbalanced force produces on an object depends on

_____the force acts on a body.

2) Impulse   F x t = J

Combining all the equations

                  Write on your test immediately before answering questions

ex1)   A 5kg mass has its velocity change from 8 m/s east to 2 m/s east. Find the objects change in momentum

ex 2)   A 5kg mass moving with a velocity of 8 m/s east has an impulse applied to it causing its velocity to change to 20 m/s East.
                  Find the Impulse:

              Find the force if the impulse was applied for 3 sec.

ex 3)   How long would it take for a net upward force of 100N, to increase the speed of a 50kg from 100 m/s to 150 m/s.

ex4)   A 1.0kg ball traveling @ 4 m/s strikes a wall and bounces straight back @ 2m/s.

   Find _____

   (a)   =   = _____

   (b) What is impulse applied to the wall?