**BLOSSOMS VIDEO LESSON TRANSCRIPT**

**Forces and Angles**

Hello, I’m Bahtiar

a physics teacher

from Kuching North Science Secondary School in Malaysia.

Through this video,

we are going to study some concepts

on Forces and Angles.

Let’s watch this scene.

Adam seems to have difficulties

in dragging the rubbish bag.

Why do you think Ali is not having

Experiment with your friends

and see why

Adam is having difficulty

in dragging the bag

with these materials.

Now,

assume that the uniform wooden block

provided to you by your teacher

represents the rubbish bag.

Attach one end of the string

to a wooden block

and the other end to a spring scale.

Drag the wooden block

by along a smooth surface

by pulling the spring scale.

Try to keep the angle

of the string with respect to the ground

as constant as possible

and record the reading on the spring scale.

Then,

repeat the procedure

but with different angles

with respect to the ground.

At which angle did you find it easier

to drag the wooden block?

Please report your findings to the class

See you in a while.

Activity 1

Earlier,

you were asked to find out

why Adam is having difficulty

dragging the rubbish bag.

Through the experiment,

you were asked to drag a wooden block

at different angles

with respect to the ground.

What have you found out?

Yes,

you are right!

It is easier to drag the wooden block

with a smaller angle to the ground

Now,

let us observe

another scene

of a child

sitting on the flat area

of the playground slide

and then sliding down

along the inclined-plane of the slide.

Have you ever slide down a slide before?

Do you move downwards

when you are sitting stationary on the flat area

at the top of the slide?

What would happen to you

when you sit on the inclinedplane of the slide?

Now with reference to the slide,

when would a wooden block

start to slide downwards

if it is placed on tilted plywood?

Let us find out in the next activity.

You will be given:

a piece of plywood,

a wooden block

and seven to eight pieces of bricks.

Now, please work together in a group of four,

plan and carry out an activity

to investigate

what would cause the wooden block

to slide downwards along a tilted plywood.

You will also have to answer these questions

Questions 1

How can you make the wooden block accelerate at a greater down the slope?

What causes the wooden block to accelerate at a greater rate when the plane is being tilted?

How do you think this happens?

Activity 2

Back to the questions earlier

Question 1

How can you make the block

accelerate at a greater rate down the slope?

Yes,

the wooden block can be made to accelerate

at a greater rate by increasing

the angle of inclination of the plywood

Question 2What causes the wooden block

to move when the plane is being tilted?

There must be force acting on the object

that pushes it downwards

along the plane.

Question 3

How do you think this happens?

An object placed on a tilted surface

will often slide down the surface.

A tilted surface is called an

inclined plane.

The rate at which the object accelerates down the surface

is dependent upon how tilted the surface is;

the greater the tilt of the surface,

the greater the acceleration of the object down the slope.

Objects tend to accelerate

down inclined planes because

of an unbalanced force.

The normal force

always acts in the upwards direction,

opposite to the direction of the force of gravity.

This is true

when the objects are placed on horizontal surface.

On a flat plane,

the perpendicular component of force of gravity

is directed opposite the normal force

and as such balances the normal force.

But normal forces are not always acting upwards,

but rather

that they always directed

perpendicular to the surface

that the object is on.

On an inclined plane

assumed to be friction-free,

the normal force does not

act directly opposite to the direction of gravity.

Usually,

any force,

a vector quantity,

directed at an angle to the horizontal

can be resolved into 2 or more component forces.

Here,

the force can be broken down into **two** components,

the **horizontal** and **vertical** component.

The force of gravity here

is resolved into two component forces

one directed perpendicular to the inclined surface (F**⊥**)

and the other directed parallel to the inclined surface (F*II*).

On an inclined plane,

the force parallel to the inclined plane is FII,

which is the parallel component of the force of gravity.

This force is not balanced by any other force.

Thus,

the object will subsequently accelerate

down the inclined plane

due to the presence of an unbalanced force.

It is the parallel component of the force of gravity

that causes this acceleration.

The parallel component of the force of gravity

is the net force.

In the presence of friction

or other forces,

the situation is slightly more complicated.

The perpendicular component of force,

(F⊥), still balances the normal force

since objects do not accelerate

perpendicular to the incline.

Yet the frictional force

must also be considered

when determining the net force.

As in all net force problems,

the net force is the vector sum of all the forces.

That is,

all the individual forces

are added together as vectors.

Now,

let us watch another scene

of a family moving into their new house

What can you suggest

to help the mover

unload the goods

easily from a fixed height?

Let’s find out more in the next activity.

Now working groups of fours

and conduct an experiment to find out

the relationship between the angle of

inclination of plank

or plywood and the force

exerted on the load.

Each group is given

a few pieces of plywood or wooden plank

of lengths half a meter

1 meter

1.5 meters

a spring scale,

5 pieces of bricks,

a plastic bottle filled with sand

Please answer these questions

Question 1

What are the forces

acting on the plastic bottle

filled with sand when placed

on the inclined plane?

Question 2

What will happen to these forces

when the angle of inclined plane is increased?

Activity 3

So what are the forces acting on the plastic bottle

filled with sand

on an inclined plane?

The forces acting on the

plastic bottle are

the horizontal component of the force of

gravity on the plastic bottle

and the tension in the spring

So question 2

What will happen to these forces

when the angle of inclined

plane is increased?

These forces will increase accordingly.

So this experiment

shows that by increasing the

angle of the plank,

the home mover

can slide the object down easily.

The variation in the angle of inclination

of an inclined plane

can affect the force exerted on the object

placed on the plane.

As the angle of the inclined plane is increased,

the force on the object along the plane is increased.

As the angle increases,

the component of force

parallel to the inclined plane increases

and the component of force perpendicular

to the inclined plane decreases.

It is the parallel component of the weight vector

that causes the movement along the plane.

Thus,

the force on the object

is greater at greater angles of inclination.

Based on what you have learned

on resolution of forces

what can you suggest to help Joe

move the travelling bag with ease?

Let’s find out in the next activity.

You are provided with a travelling bag

with two wheels.

Work in a group of 4

Collaboratively,

find out whether it is easier to push

or pull a travelling bag

on an uneven surface.

Perform the experiment,

discuss and present your answer to the class.

Activity 4

Now,

have you found out whether it is easier

to pull or to push

a two wheeled travelling bag?

Yes, it is easier to pull

rather than to push

a two wheeled travelling bag

along an uneven surface.

Well,

in this lesson,

we have seen that the resolution of forces

on objects is a common and widely applied concept.

We have identified the forces acting on objects

and its resolution of forces

related to our daily activities

like when objects are pulled at different angles,

or when they are moving down along planes of varying angles.

You can also relate the concept of forces

resolution in daily activities around you,

for example,

the forces acting on the handle

of a garden lawn mower

when mowing the lawn

and a snow skier moving down a slope.

The force on the handle of a garden lawn mower

when mowing the lawn

When a lawn mower is pushed

it does not move in the direction it is pushed.

It moves in the direction

parallel to the surface of the ground.

The force that acts along the handle

at an angle to the surface of the ground

is resolved into two components.

One component acts horizontally

and moves the mower along the ground.

The other component acts vertically

and tends to push the mower into the ground.

The force exerted on a snow skier

moving down a slope:

Here, the force of gravity

(weight) of the skier will be resolved

into two components forces

one directed perpendicular to the slope

(W1)

and the other directed parallel to the slope (WII).

If the parallel component of the weight of the skier

is balanced by the frictional force on the ground,

the skier stays stationary.

But if the frictional force is

less than the parallel component

of the weight (or if the skier

pushes himself forward with the ski),

then the resultant force will

subsequently cause the skier

to accelerate down the slope.

It is the parallel component of the force of gravity

that causes this acceleration.

The parallel component of the force of gravity

is the net force.

We hope that

after following our lesson,

you have understood some concept

of forces and angles

and relate it to familiar activities around you.

We wish you all the best

and thank you for using

BLOSSOMS video lessons.

Teacher’s Guide

Hi, there!

The context of this video

is in Malaysia.

However,

you are welcome to adapt

and adopt

the activities according

to your context or similar

daily application.

Please note that

this video is to help students

of ages 15-16

understand better about the resolution of forces

and learn how to draw free body diagrams.

Students should have knowledge of trigonometry,

so you need to do some revision on

simple trigonometry to enhance

students problem solving on

resolution of forces.

Most of the materials required

and can be easily made available.

You have to guide and encourage students

Materials and apparatus required for:

It is hoped that

students will enjoy learning and constructing

new knowledge through this

inquiry based learning approach.