WJEC (Wales) Physics A-level

SP1.3 - Investigation of Newton's Second Law

Practical Flashcards

State Newton’s Second Law in words.

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Newton’s Second Law states that an object’s acceleration will be directly proportional to the resultant force acting on the object, and inversely proportional to its mass.

What is the defining equation of Newton’s Second Law?

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Resultant Force = Mass x Acceleration

$$F = ma$$

What is the advantage of using an air-track in this experiment?

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The air-track will make the resistive friction force negligible, meaning the resultant force is equal to the weight of the hanging masses.

What assumption is made about the pulley in this experiment?

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The pulley is assumed to be frictionless in this experiment.

If an air-track is unavailable, how could the friction of the slope be compensated for?

If an air-track is unavailable, how could the friction of the slope be compensated for?

The slope can be set-up at a slight angle so as to compensate for the frictional force. This technique is still likely to result in less accurate results than using an air-track.

How is the force acting on the trolley determined?

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The force is equal to the weight of the masses and mass hanger:

$$F = mg$$

What does the total mass of the system equal in this experiment?

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Total Mass of System = m + M

m: mass of mass hanger and masses

M: mass of the rider

What assumption is made about the string in this experiment?

What assumption is made about the string in this experiment?

The mass of the string is assumed to negligible in this experiment. To ascertain more precise results, you could include this mass in your calculations.

How can the acceleration of the rider be measured in this experiment?

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Two light-gates can be set up to measure the velocity of the rider at two positions. The distance between the gates can be measured, then the acceleration can be found using SUVAT equations.

What equation can be used to determine the acceleration from the light-gate velocity readings and separation?

What equation can be used to determine the acceleration from the light-gate velocity readings and separation?

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

$$a = (v^2 - u^2)/2s$$

How can the acceleration be determined using just a single light-gate?

How can the acceleration be determined using just a single light-gate?

The initial velocity of the rider can be taken to be zero. The velocity of the rider through the gate, and the distance from the start to the gate, can then be substituted into: $a = (v^2)/2s$

What should the acceleration of the system equal to according to Newton's Second Law?

What should the acceleration of the system equal to according to Newton’s Second Law?

$$a = \frac{mg}{(M + m)}$$

Describe what your graph of acceleration against mass-hanger weight should look like.

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The acceleration and the mass-hanger weight should be directly proportional to each other. This means the graph should form a straight line that passes through the origin.

If the mass of the rider is unknown, how could this be determined from your graph?

If the mass of the rider is unknown, how could this be determined from your graph?

The gradient of the graph should equal 1/(m+M). This means that the mass of the rider will equal the inverse of the gradient minus the sum of the mass of the slotted masses and the hanger.

Why should you place any masses removed from the hanger onto the rider?

Why should you place any masses removed from the hanger onto the rider?

By placing any masses removed from the hanger onto the rider, the total mass of the system remains constant throughout the experiment.

What safety precautions should be taken in this experiment?

What safety precautions should be taken in this experiment?

Falling masses can cause injury. Avoid standing with your feet near the hanging masses and ensure that the masses added to the rider are securely fastened.