# **Physics – Force and Motion**

# **Worksheet – Free Body Diagram**

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| --- | --- | --- |
| Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_( ) | Class: \_\_\_\_\_\_\_\_\_\_\_\_ | Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

## **Objective**

1. Recognize the importance and use of free body diagram.
2. Use free body diagram to show the forces acting on different objects.
3. Generalize the characteristics of common forces acting on the objects.

## **Brief Summary**

|  |  |  |
| --- | --- | --- |
| **Common forces acting on object X** | **How does the forces occur?** | **When do we need to draw it?** |
| Weight (重量) | Gravity acts on the object | X has weight |
| Normal force (正向力) | The force acting on X by a contacting object underneath X to prevent it from passing through the surface | X is leaning on/ resting on another object/surface |
| Tension (張力) | Rope/string that pulls X | A taut (拉緊) string/ rope is attached to X |
| Friction (摩擦力) | Force acting on X by another object at their contacting surface of X to oppose its intended motion | The contact surface is rough/not smooth |
| External force (外力)   * Push (推力) * Pull (拉力) | Force exert on X by another object | An external force pushing/pulling X |

**What is free body diagram?**

A graphical illustration used to visualize three elements on a body in a given condition:

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The free body diagram can help us to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ using Newton’s Second Law of motion.

**Guidelines of drawing a free body diagram**

* Each force in the diagram is shown as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pointing in the direction they act on the body.
* The \_\_\_\_\_\_\_\_\_ of the arrows indicate the points where the forces act on the body.
* The \_\_\_\_\_\_\_\_\_ of the arrows indicate the magnitude (amount) of the forces.
* If there exist multiple bodies in the system, draw the free body diagram of the bodies \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

## **I - Predict**

1. Write down the name of the forces that acting on the block in different figures.
2. Illustrate all the forces in the figures graphically.

|  |  |  |
| --- | --- | --- |
| block under free falling | | Forces act on the block |
| block resting on the table | | Forces act on the block: |
| block resting on inclined surface | | Forces act on the block: |
| Simple pulley systemImage result for 1 pulley two blocks | block **one**  Image result for 1 pulley two blocks | Forces act on block **one**: |
| block **two**  Image result for 1 pulley two blocks | Forces act on block **two**: |

## **II - Observe**

**Draw the free body diagram and name the force in each demonstration**

|  |  |  |  |
| --- | --- | --- | --- |
| Block being pushed | | Block being pulled | Forces act on the block: |
| block resting on inclined surface | | | Forces act on the block: |
| Simple pulley system (1)  Image result for 1 pulley two blocks | block one Image result for 1 pulley two blocks | | Forces act on the block **one**: |
| block two  Image result for 1 pulley two blocks | | Forces act on the block **two**: |
| Simple pulley system (2)  https://docs.google.com/drawings/d/sXIl7pBj5-wYTusR-VP6LYw/image?w=271&h=149&rev=40&ac=1&parent=1PHM0JeOZzhHIkmqNwxe3V9D1CL_Xct4nPXO5QaG0owc | | | Forces act on the block **one**: |
| block one (heavier) | | block two (lighter) | Forces act on the block **two**: |

## **III - Explain**

**Characteristics all the common forces acting on a body and state the point of application near the diagram.**

|  |  |  |
| --- | --- | --- |
| **Normal forces** | Example | |
| Label: | N  e.g. Arrow pointing from the contact surface | |
| Direction of arrows: |
| **Weight** | Example | |
| Label: |  | |
| Direction: |
| **Friction** | Example | |
| Label: | Intended moving direction | |
| Direction: |
| **Tension** | Example | |
| Label: |  | |
| Direction: |
| **External force – push /pull** | Example | |
| Label: | Push | Pull |
| Direction: |