Student Name: ______________________	**Class:** ______________________
Student ID: ______________________	**Date:** ______________________

Assessment Details

Duration: 45 minutes	**Total Marks:** 100
Topics Covered:	• Contact and Non-Contact Forces • Effects of Forces on Objects • Friction, Gravity, and Magnetism

Instructions to Students:

1. Read all questions carefully before attempting.
2. Show all working out - marks are awarded for method.
3. Calculator use is permitted except where stated otherwise.
4. Write your answers in the spaces provided.
5. If you need more space, use the additional pages at the end.
6. Time management is crucial - allocate approximately 1 minute per mark.

Section A: Multiple Choice [20 marks]

Question 1 **[2 marks]**

What type of force is gravity?

A) Contact force	B) Non-contact force
C) Friction force	D) Pushing force

Question 2 **[2 marks]**

Which of the following is an example of a contact force?

A) Magnetism	B) Friction
C) Gravity	D) Air resistance

Question 3 **[2 marks]**

What happens to an object when a force is applied to it?

A) It remains stationary	B) It changes direction
C) It accelerates	D) It decelerates

Section B: Short Answer Questions [40 marks]

Question 4 [8 marks]

Provide an example of a contact force and explain how it affects an object.

Question 5 [8 marks]

Describe the effect of gravity on a rolling ball.

Question 6 [8 marks]

What is the difference between a contact force and a non-contact force? Provide an example of each.

Section C: Diagram Labeling [20 marks]

Question 7

[10 marks]

Provide a diagram of a scenario where both contact and non-contact forces are present (e.g., a ball rolling down a slope with friction and gravity acting upon it). Label the forces at play and describe their effects on the ball's motion.

Question 8

[10 marks]

Label the forces acting on the following diagram and describe their effects on the motion of the objects.

Forces Diagram

Section D: Extended Response [20 marks]

Question 9 — [10 marks]

A surveyor needs to calculate the height of a tall building. Standing 30 meters from the base of the building, they measure the angle of elevation to the top as 38°. Calculate the height of the building, showing all working.

Question 10 — [10 marks]

Design and build a Rube Goldberg machine that demonstrates the effects of contact and non-contact forces. Test and evaluate your machine, identifying the forces at play and describing their effects on the motion of the objects.

Additional Space for Answers

Forces in Everyday Life

Forces are present in every aspect of our daily lives, from the simplest actions like walking or picking up a pen, to complex machinery and technological devices. Understanding how forces work and interact with each other is crucial for designing, building, and using these devices efficiently and safely.

Example: Forces in a Car

When driving a car, several forces are at play. The engine produces a forward force (thrust) that propels the car. Friction between the tires and the road provides the necessary grip for the car to move forward without slipping. At the same time, air resistance (drag) acts opposite to the direction of motion, slowing the car down. The balance of these forces determines the car's acceleration, speed, and overall performance.

Sub-Question: Force and Motion in Sports

In sports, understanding forces and motion is vital for optimizing performance and reducing injury. For instance, in football, the force exerted by a player's foot on the ball determines its speed and direction. Similarly, in gymnastics, athletes must carefully manage the forces acting on their bodies to execute complex maneuvers safely and effectively.

Energy and Work

Energy is the ability to do work, and work is done when a force is applied to an object, causing it to move a certain distance. The relationship between energy, work, and forces is fundamental in understanding how machines and devices operate. Different types of energy, such as kinetic energy (the energy of motion), potential energy (stored energy), and thermal energy (the energy of heat), are all related to forces and are crucial in various applications.

> The formula for work done (W) by a force (F) over a distance (d) is given by $W = F * d$. This formula highlights the direct relationship between force, distance, and the work done.

Case Study: Energy Efficiency in Buildings

In designing energy-efficient buildings, architects and engineers consider the forces involved in heating, cooling, and lighting. By minimizing the forces required for these processes (e.g., through insulation, double glazing, and solar panels), buildings can significantly reduce their energy consumption, leading to cost savings and a reduced carbon footprint.

Momentum and Collisions

Momentum, the product of an object's mass and velocity, is a measure of the tendency of an object to keep moving in a straight line. Collisions, where objects interact with each other through forces, can result in the transfer of momentum. Understanding momentum and collisions is essential in fields like transportation, sports, and materials science.

Example: Momentum in Hockey

In ice hockey, players use sticks to hit a puck into the opponent's goal. The momentum of the puck, determined by its mass and velocity, affects how far it travels and how difficult it is to stop. Players must manage the forces exerted on the puck to control its momentum and achieve their desired outcome.

Sub-Question: Conservation of Momentum

The principle of conservation of momentum states that in a closed system (where no external forces act), the total momentum before a collision is equal to the total momentum after the collision. This principle is useful in analyzing and predicting the outcomes of collisions in various scenarios, from car accidents to astronomical events.

Rotational Motion and Torque

Rotational motion, where objects move in a circular path around a fixed axis, involves forces that cause rotation, known as torques. Understanding rotational motion and torque is critical in the design of engines, gears, and other mechanical systems.

The formula for torque (τ) is given by $\tau = r * F * \sin(\theta)$, where r is the distance from the axis of rotation to the point where the force is applied, F is the magnitude of the force, and θ is the angle between the force and the radius vector. This formula shows how torque depends on the force, distance, and angle.

Case Study: Efficiency in Wind Turbines

Wind turbines convert the kinetic energy of the wind into electrical energy through rotational motion. The design of the turbine blades and the gearbox is crucial for maximizing the torque and, consequently, the energy output. Engineers must balance the forces acting on the turbine to optimize its performance and durability.

Simple Harmonic Motion

Simple harmonic motion (SHM) occurs when the force acting on an object is proportional to its displacement from a fixed point, causing the object to oscillate. SHM is observed in pendulums, springs, and many other systems, and its understanding is vital for the analysis and design of oscillating systems.

Example: Pendulum Clock

A pendulum clock uses the consistent oscillations of a pendulum to measure time. The force of gravity acting on the pendulum causes it to swing in SHM, with its period determined by its length and the acceleration due to gravity. The predictable nature of SHM allows for precise timekeeping.

Sub-Question: Damping and Resonance

In real-world systems, SHM is often affected by damping forces that reduce the amplitude of oscillations over time. Additionally, when the frequency of an external force matches the natural frequency of a system, resonance occurs, leading to amplified oscillations. Understanding damping and resonance is crucial for controlling and optimizing the behavior of oscillating systems.

Waves and Vibrations

Waves and vibrations are related to forces that cause oscillations to propagate through a medium. This topic includes the study of mechanical waves (like water waves and sound waves) and electromagnetic waves (like light and radio waves), which are essential for communication, energy transfer, and many technological applications.

The speed (v) of a wave is given by $v = \lambda * f$, where λ is the wavelength and f is the frequency. This relationship shows how the characteristics of a wave are interconnected.

Case Study: Seismic Waves in Earthquakes

During an earthquake, seismic waves are generated and travel through the Earth, causing the ground to shake. Understanding the types of seismic waves (P-waves, S-waves, and surface waves) and their speeds is crucial for seismologists to determine the epicenter and magnitude of an earthquake, which aids in emergency response and damage assessment.

PLANIT TEACHERS

Forces and Motion Assessment

Student Name: ____________________	**Class:** ____________________
Student ID: ____________________	**Date:** ____________________

Assessment Details

Duration: 45 minutes	**Total Marks:** 100
Topics Covered:	• Contact and Non-Contact Forces • Effects of Forces on Objects • Friction, Gravity, and Magnetism

Instructions to Students:

1. Read all questions carefully before attempting.
2. Show all working out - marks are awarded for method.
3. Calculator use is permitted except where stated otherwise.
4. Write your answers in the spaces provided.
5. If you need more space, use the additional pages at the end.
6. Time management is crucial - allocate approximately 1 minute per mark.

Section A: Multiple Choice [20 marks]

Question 1 [2 marks]

What type of force is gravity?

A) Contact force

B) Non-contact force

C) Friction force

D) Pushing force

Question 2 [2 marks]

Which of the following is an example of a contact force?

A) Magnetism

B) Friction

C) Gravity

D) Air resistance

Question 3 [2 marks]

What happens to an object when a force is applied to it?

A) It remains stationary

B) It changes direction

C) It accelerates

D) It decelerates

Section B: Short Answer Questions [40 marks]

Question 4

[8 marks]

Provide an example of a contact force and explain how it affects an object.

Question 5

[8 marks]

Describe the effect of gravity on a rolling ball.

Question 6

[8 marks]

What is the difference between a contact force and a non-contact force? Provide an example of each.

Section C: Diagram Labeling [20 marks]

Question 7 [10 marks]

Provide a diagram of a scenario where both contact and non-contact forces are present (e.g., a ball rolling down a slope with friction and gravity acting upon it). Label the forces at play and describe their effects on the ball's motion.

Question 8 [10 marks]

Label the forces acting on the following diagram and describe their effects on the motion of the objects.

Forces Diagram

Section D: Extended Response [20 marks]

Question 9 **[10 marks]**

A surveyor needs to calculate the height of a tall building. Standing 30 meters from the base of the building, they measure the angle of elevation to the top as 38°. Calculate the height of the building, showing all working.

Question 10 **[10 marks]**

Design and build a Rube Goldberg machine that demonstrates the effects of contact and non-contact forces. Test and evaluate your machine, identifying the forces at play and describing their effects on the motion of the objects.

Additional Space for Answers