Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/21**

Paper 2 Multiple Choice (Extended) **May/June 2017**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)

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READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
Electronic calculators may be used.
Take the weight of 1.0 kg to be 10 N (acceleration of free fall = 10 m / s^2).

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **18** printed pages and **2** blank pages.

1 What is the most accurate and precise method to measure the thickness of a coin?

A Use a micrometer screw gauge.

B Use a ruler and look at the scale perpendicularly.

C Use a top pan balance.

D Use the displacement method with water in a measuring cylinder.

Answer

The most accurate and precise method to measure the thickness of a coin is to use a micrometer screw gauge. A micrometer screw gauge is specifically designed for measuring small dimensions with high precision and accuracy, making it ideal for measuring the thickness of objects like coins.

Let's evaluate the options:

A. Use a micrometer screw gauge.

Correct. This tool provides high accuracy and precision for measuring thickness.
B. Use a ruler and look at the scale perpendicularly.

Incorrect. While this method is simple, it is not as precise as using a micrometer for small measurements like the thickness of a coin.
C. Use a top pan balance.

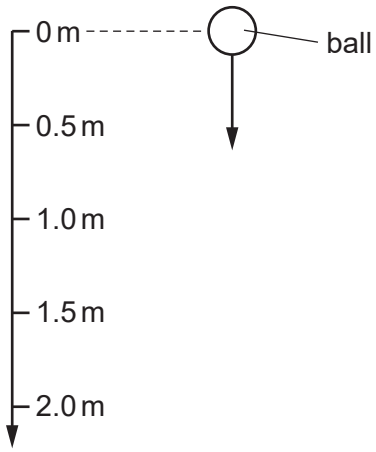
Incorrect. A balance measures mass, not thickness.
D. Use the displacement method with water in a measuring cylinder.

Incorrect. This method is used to measure volume, not thickness, and is not practical for measuring the thickness of a coin.

The correct answer is option A: Use a micrometer screw gauge.

2 On Earth, a ball is dropped and falls 2.0 m in a vacuum.

The acceleration of the ball at 1.0 m is 10 m / s^2.



What is the acceleration of the ball at 0.5 m?

A 5.0 m / s^2 **B** 10 m / s^2 **C** 15 m / s^2 **D** 20 m / s^2

Answer

The correct answer is B: 10 m/s².

Step-by-Step Explanation:
Understanding Acceleration Due to Gravity

The ball is falling in a vacuum, meaning there is no air resistance.
On Earth, the acceleration due to gravity (g) is always 10 m/s², regardless of height.
Checking Given Information

The problem states that the acceleration at 1.0 m is 10 m/s².
Since acceleration due to gravity is constant, it remains 10 m/s² at all heights, including at 0.5 m.
Why Not Other Options?

A (5.0 m/s²) → Incorrect, because acceleration due to gravity does not decrease at lower heights.
C (15 m/s²) → Incorrect, because gravity remains constant.
D (20 m/s²) → Incorrect, because Earth's gravity is 10 m/s², not 20 m/s².
Final Answer:
B: 10 m/s²

3 A skydiver reaches terminal velocity. Then he opens his parachute.

What happens to the skydiver as the parachute opens?

A There is a decrease in weight.

B There is acceleration upwards.

C There is an increase in speed.

D There is movement upwards.

Answer

When a skydiver reaches terminal velocity, the forces of gravity and air resistance are balanced, resulting in no further acceleration. Upon opening the parachute, the situation changes as follows:

The parachute increases the surface area, significantly increasing air resistance. The increased air resistance becomes greater than the force of gravity, causing the skydiver to decelerate or slow down.
Let's evaluate the options:

A. There is a decrease in weight.

Incorrect. The weight of the skydiver remains constant as it is determined by mass and gravitational acceleration.
B. There is acceleration upwards.

Correct. When the parachute opens, the additional air resistance causes a net upward force, resulting in upward acceleration (deceleration downward).
C. There is an increase in speed.

Incorrect. The speed decreases because the parachute creates additional air resistance.
D. There is movement upwards.

Incorrect. The skydiver does not move upwards; rather, they continue to fall but at a slower speed.

The correct answer is option B: There is acceleration upwards.

4 A piece of steel is taken from the Earth to the Moon for an experiment. The gravitational field strength on the Moon is smaller than on the Earth.

Which statement about the piece of steel is correct?

A It has less mass on the Moon than on the Earth.

B It has more mass on the Moon than on the Earth.

C It weighs less on the Moon than on the Earth.

D It weighs more on the Moon than on the Earth.

Answer

When a piece of steel is taken from the Earth to the Moon, its mass remains the same because mass is an intrinsic property of matter and does not change with location. However, weight, which is the force due to gravity acting on the mass, does change depending on the gravitational field strength.

Let's evaluate the options:

A. It has less mass on the Moon than on the Earth.

Incorrect. The mass remains the same regardless of location.
B. It has more mass on the Moon than on the Earth.

Incorrect. The mass is constant and does not change with location.
C. It weighs less on the Moon than on the Earth.

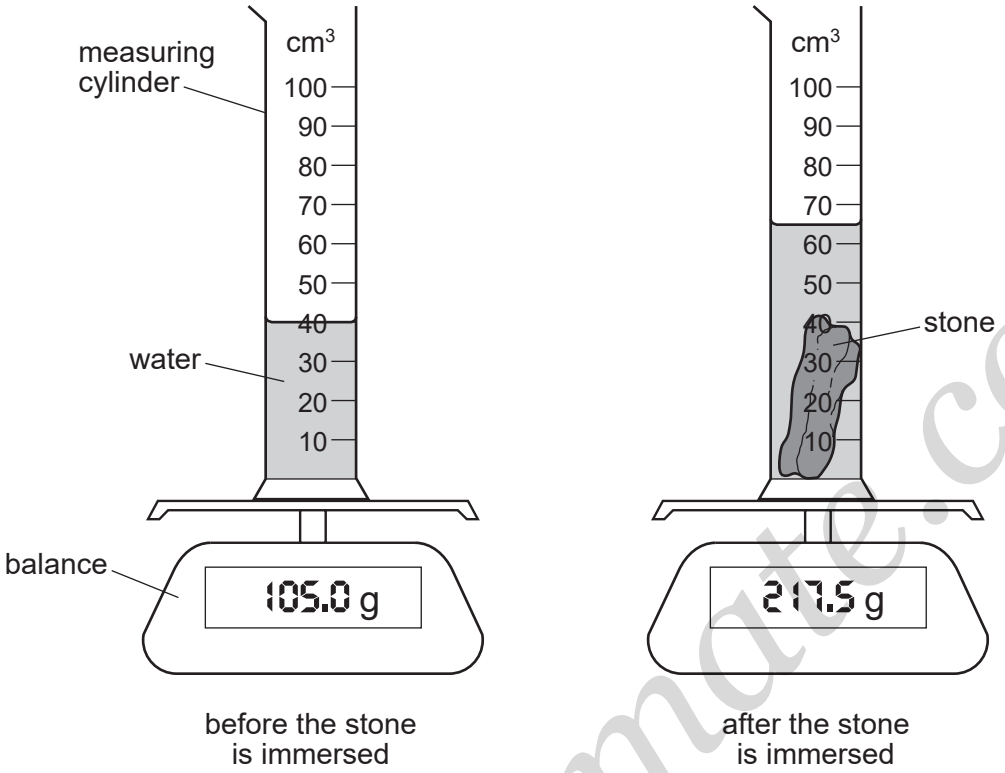
Correct. Weight is dependent on gravitational field strength, which is weaker on the Moon than on the Earth, resulting in less weight.
D. It weighs more on the Moon than on the Earth.

Incorrect. The weaker gravitational field on the Moon means it weighs less.

The correct answer is option C: It weighs less on the Moon than on the Earth.

5 A measuring cylinder containing only water is placed on an electronic balance. A small, irregularly shaped stone is now completely immersed in the water.

The diagrams show the equipment before and after the stone is immersed.



What is the density of the material of the stone?

A $1.7\,g/cm^3$ **B** $3.3\,g/cm^3$ **C** $4.5\,g/cm^3$ **D** $8.7\,g/cm^3$

Answer

The correct answer is C: 4.5 g/cm³.

Step-by-Step Explanation
1. Find the Mass of the Stone
Mass before immersion (water + measuring cylinder) = 105.0 g
Mass after immersion (water + measuring cylinder + stone) = 217.5 g
Mass of the stone = 217.5 g - 105.0 g = 112.5 g
2. Find the Volume of the Stone
Initial water level = 30 cm³
Final water level = 55 cm³
Volume displaced by the stone (which is equal to the volume of the stone) = 55 cm³ - 30 cm³ = 25 cm³
3. Calculate the Density of the Stone
Density formula: Density = Mass / Volume
Density of the stone = 112.5 g / 25 cm³
Density = 4.5 g/cm³

Final Answer:
C: 4.5 g/cm³

6 A boat is travelling at a steady speed in a straight line across the surface of a lake.

Which statement about the boat is correct?

A The resultant force on the boat is in the direction of motion.

B The resultant force on the boat is in the opposite direction to its motion.

C The resultant force on the boat is vertically downwards.

D The resultant force on the boat is zero.

Answer
Let's analyze this using Newton's Laws of Motion:

Newton's First Law states that an object will remain in uniform motion (constant velocity) unless acted upon by a net force.

In this case, we know:

The boat is moving at a "steady speed" (constant velocity)
It's moving in a "straight line" (no change in direction)
This means there is no acceleration

Let's examine each option:

Option A: Resultant force in direction of motion
Incorrect: This would cause acceleration forward
The boat would speed up, not maintain steady speed

Option B: Resultant force opposite to motion
Incorrect: This would cause deceleration
The boat would slow down

Option C: Resultant force vertically downwards
Incorrect: This would cause the boat to sink
The boat is floating, so upward buoyancy balances downward weight

Option D: Resultant force is zero
Correct!
For constant velocity motion, all forces must balance
Forward thrust balances water resistance
Upward buoyancy balances downward weight
Net force = 0 allows steady speed in straight line

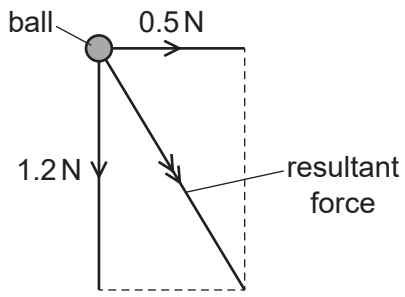
Therefore, the correct answer is D: The resultant force on the boat is zero.
This follows directly from Newton's First Law - an object moving at constant velocity must have zero net force acting on it.

7 A ball of weight 1.2 N drops through the air at terminal velocity.

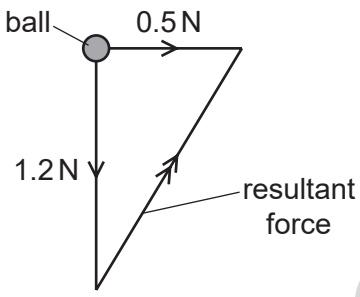
A sudden gust of wind exerts a horizontal force of 0.5 N on the ball from the left.

Which diagram shows the resultant force on the ball while the wind is blowing?

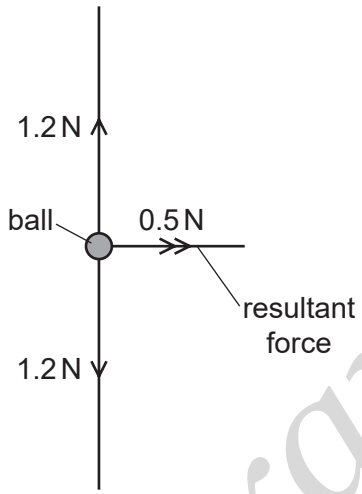
A



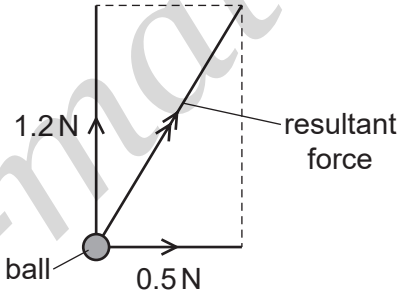
B



C



D



When a ball is falling at terminal velocity, it is in a state of dynamic equilibrium, meaning that the forces acting on it are balanced. The forces involved are:

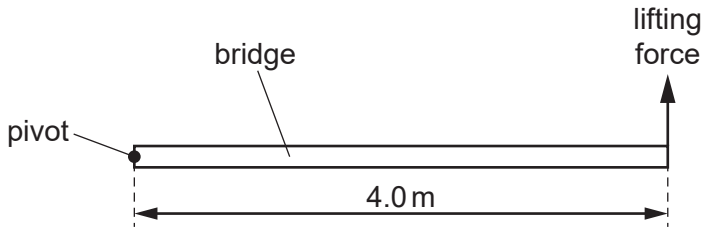
The weight of the ball (1.2 N), acting downward due to gravity.
The horizontal force exerted by the wind (0.5 N), acting to the left.
At terminal velocity, the vertical force (weight) is exactly balanced by the air resistance (drag).
Since the wind is blowing from the left, it creates a horizontal force.

To find the resultant force:

The weight is vertically downward (1.2 N).
The horizontal force from the wind is 0.5 N to the left.
The resultant force is the vector sum of these two forces, and it will form a diagonal vector.
Analyzing the Diagrams:
Diagram A: The resultant force is directed diagonally downward to the right, which is not correct.
Diagram B: The resultant force is directed diagonally downward to the right, which is also incorrect.
Diagram C: The resultant force is directed diagonally downward to the left, which is correct since it shows the weight downward and the horizontal force to the left.
Diagram D: The resultant force is directed diagonally upward to the right, which is incorrect.
Correct Answer:
C) Diagram C is the correct representation of the resultant force.

8 The diagram shows a uniform bridge, 4.0 m long and weighing 10 000 N.

The bridge is pivoted at one end. A force at the other end gradually increases until the bridge begins to lift.



What is the lifting force as the bridge starts to move upwards?

A 2500 N **B** 5000 N **C** 10 000 N **D** 20 000 N

To solve this problem, we need to use the concept of moments (torque). The bridge is pivoted at one end, and a force at the other end gradually increases until the bridge starts to lift. At the point when the bridge starts to lift, the moment caused by the lifting force must balance the moment caused by the weight of the bridge.

Given:
Length of the bridge = 4.0 m
Weight of the bridge = 10,000 N
Pivot is at one end (the left end of the bridge).
Step-by-Step Analysis:
Weight of the bridge (W):

The weight of the bridge acts at its center of gravity, which is at the midpoint of the bridge (2.0 m from the pivot).
The moment due to the weight is calculated as:
Moment due to the weight = Weight × Distance from the pivot
Moment due to the weight = 10,000 N × 2.0 m = 20,000 N·m.
Lifting force (F):

The lifting force acts at the far end of the bridge (4.0 m from the pivot).
To balance the moment caused by the weight, the moment due to the lifting force must be equal to the moment caused by the weight.
Moment due to the lifting force = Force × Distance from the pivot
For the bridge to start lifting, the moments must be equal:
F × 4.0 m = 20,000 N·m
Solving for F:
F = 20,000 N·m / 4.0 m = 5,000 N.
Conclusion:
The lifting force when the bridge starts to move upwards is 5,000 N.

Thus, the correct answer is B (5000 N).

9 A bullet of mass 0.10 kg travels horizontally at a speed of 600 m/s. It strikes a stationary wooden block of mass 1.90 kg resting on a frictionless, horizontal surface.

The bullet stays in the block.

What is the speed of the bullet and the block immediately after the impact?

A 30 m/s **B** 32 m/s **C** 60 m/s **D** 134 m/s

To find the speed of the bullet and block immediately after the impact, we can use the principle of conservation of momentum. The total momentum before the impact must equal the total momentum after the impact.

Calculate the initial momentum of the bullet:

Mass of the bullet = 0.10 kg
Speed of the bullet = 600 m/s
Initial momentum = mass * speed = 0.10 kg * 600 m/s = 60 kg m/s
Calculate the final momentum of the combined bullet and block system:

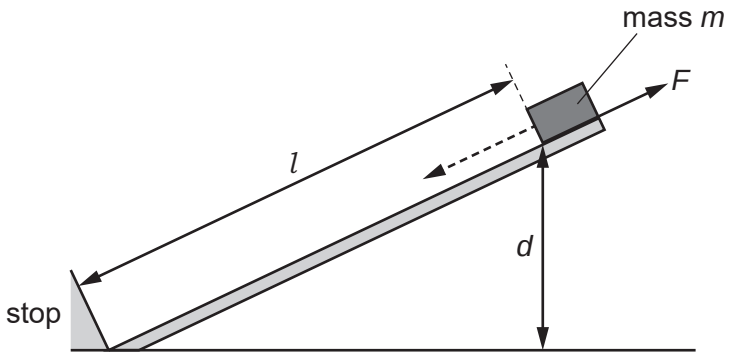
Mass of the block = 1.90 kg
Total mass of the bullet and block = 0.10 kg + 1.90 kg = 2.00 kg
Use the conservation of momentum:

Initial momentum = Final momentum
60 kg m/s = 2.00 kg * final speed
Solve for the final speed:

Final speed = 60 kg m/s / 2.00 kg = 30 m/s

The speed of the bullet and block immediately after the impact is 30 m/s. The correct answer is option A: 30 m/s.

10 A box of mass *m* slides down a slope of length *l* and vertical height *d* against a frictional force *F*.



As the box slides down the slope, it loses gravitational potential energy and it does work against the friction.

Which row gives the loss in gravitational potential energy and the work done against friction?

	loss in gravitational potential energy	work done against friction
A	*mgd*	*Fl*
B	*mgd*	*Fd*
C	*mgl*	*Fl*
D	*mgl*	*Fd*

To determine the correct row that gives the loss in gravitational potential energy and the work done against friction, let's break down the situation:

Loss in Gravitational Potential Energy:
The box is sliding down the slope from a height d. The gravitational potential energy lost by the box is given by the formula:
Gravitational potential energy lost = m * g * d, where:
m = mass of the box
g = acceleration due to gravity
d = vertical height the box descends
The correct expression for the loss in gravitational potential energy is m * g * d.
Work Done Against Friction:
The box moves a distance l along the slope, and friction acts against the motion. The work done against friction is given by:
Work done against friction = F * l, where:
F = frictional force
l = distance traveled along the slope.
The correct expression for the work done against friction is F * l.
Analyzing the Options:
Option A:
Loss in gravitational potential energy = m * g * d.
Work done against friction = F * l.
This matches the correct values.
Option B:
Loss in gravitational potential energy = m * g * d (correct).
Work done against friction = F * d (incorrect). It should be F * l.
Option C:
Loss in gravitational potential energy = m * g * l (incorrect).
Work done against friction = F * l (correct).
Option D:
Loss in gravitational potential energy = m * g * l (incorrect).
Work done against friction = F * d (incorrect).
The correct answer is A:
Loss in gravitational potential energy = m * g * d.
Work done against friction = F * l.