PHYSICAL SCIENCE : GRADE 11 **TEST 1**

MECHANICAL SYSTEMS

FORMULAE

$E_k = \frac{1}{2}mv^2$ $E_p = mgh$

CONSTANTS

Acceleration due to gravity (Earth)	g	9,8 $m.s^{-2}$
Avogadro's constant	N_A	6,02 x 10^{23} mol^{-1}
Molar gas volume at STP	V_O	22,4 $dm^3.mol^{-1}$

INSTRUCTIONS

This test contains 2 sections: Section A: Energy and Section B: The Mole

Write all numbers with a comma e.g. 0,71

Do not leave spaces between the number and the unit eg 0,71Hz

If there are two steps to a calculation there will be two blocks provided. Fill in the answers in the correct order.

Round final answers off to two decimal places where necessary

When answers are very small or very big, write in scientific notation and still round off to two decimal places.

SECTION A : MECHANICAL SYSTEMS **[39]**

QUESTION 1 : MULTIPLE CHOICE **[8]**

Four possible options are provided as answers to the following questions.
Each question has only one correct answer. Write only the letters (A – D) below the question number (1.1 – 1.4) in the box.

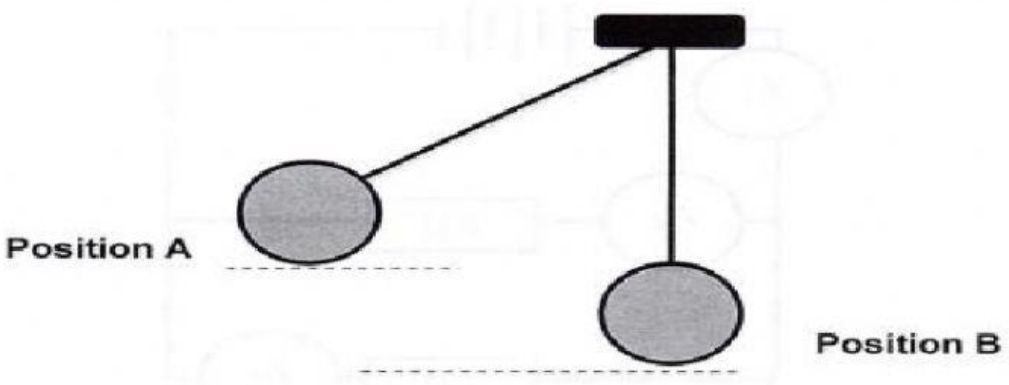
1.1 A 2kg mass falls freely from the top of a construction site, 50m high.
Which ONE of the following will remain constant as it falls towards the ground?

A. Gravitational potential energy.
B. Kinetic energy.
C. Weight.
D. Velocity.

1.2 A feather is falling vertically downward. Which one of the combination of kinetic energy and gravitational potential energy is correct for this situation?

	Kinetic energy	Gravitational potential energy
A.	increases	decreases
B.	remains constant	increases
C.	increases	increases
D.	remains constant	decreases

1.3 A sphere is released from position A as shown in the diagram below.



Which ONE of the statements below regarding the energy of the system is **INCORRECT?**

A. The gravitational potential energy at A is equal to the kinetic energy at B.
B. The kinetic energy at A is equal to the mechanical energy at A.
C. The sum of the kinetic energy and gravitational potential energy at A is equal to the sum of the kinetic energy and gravitational potential energy at B.
D. The kinetic energy at A is equal to the gravitational potential energy at B.

1.4 A body with a mass of 50 kg is lifted vertically and then released to fall freely. At a height of 5 m above the ground, the . . .

A. Potential energy is necessarily greater than the kinetic energy.
B. Kinetic energy is equal to the potential energy.
C. Sum of the potential energy and kinetic energy is unchanged.
D. Potential energy is 2 250 J.

QUESTION 2 **[9]**

Give one word / term for each of the following descriptions.

2.1 The energy an object has due to its position in a gravitational field relative to some reference point. {2 words} (2)

_____ _____

2.2 The sum of the gravitational potential energy and the kinetic energy of a system Is known as {2 words} (2)

_____ _____

2.3 Energy cannot be created or destroyed, but is merely changed from one form into another. This is known as the ..... {fill in one missing word per block} (3)

_____ of _____ of _____

2.4 The energy an object has due to its motion. {1 word} (1)

_____

2.5 The unit in which energy is measured. {1 word} (1)

_____ {write out the full word}

QUESTION 3 **[5]**

Indicate whether the following statements regarding this situation are **TRUE** or **FALSE.**

Write down only T or F

"Consider the situation where an apple falls from the top of a tree."

3.1 The potential energy of the apple is a maximum when the apple lands on the ground.

3.2 The kinetic energy remains constant throughout the motion.

3.3 To calculate the potential energy of the apple we need the mass of the apple and the height of the tree.

3.4 The mechanical energy is a maximum only at the beginning of the motion.

3.5 The apple falls at an acceleration of 9,8 $m.s^{-2}$

QUESTION 4 **[9]**

Instructions with calculations:

Enter the number ½ as 0,5

When a value or unit is squared, indicate it as follows v^2 and 4^2

4.1 A builder places a 3kg hammer on the top of a ladder, which is 4m above the ground. Calculate the gravitational potential energy of the hammer while on the ladder. (3)

Ep = m x g x h (formula)

Ep = x x {enter the numbers in the order indicated by the formula}

Ep = **{leave no spaces between value and units)**

4.2 The hammer slips off the ladder and hit the floor below. (Ignore air friction).

4.2.1 What is the value of the kinetic energy with which the hammer hits the ground?

Ek = (1)

4.2.2 Calculate the velocity of the hammer at the moment of impact. (3)

Ek = ½ m v^2 (formula)

$v = \sqrt{\frac{2 \quad x}{}}$ (change subject of formula – do not enter values yet)

$v = \sqrt{\frac{x}{}}$

v =

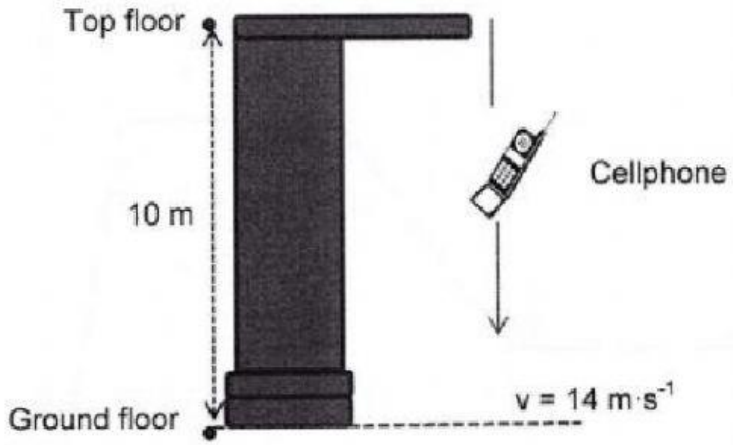
4.2.3 Convert your answer in 4.2.2 above to $km.h^{-1}$ (2)
Show working below, by entering your

_____ ÷ _____ x _____

= _____ $km.h^{-1}$

QUESTION 5 **[12]**

A woman is standing on a balcony of the top floor of a mall, which is 10m above the ground. Her cell phone with a mass of 0.01 kg falls from her hand and hits the ground below at 14 $m.s^{-1}$. Ignore the effects of air friction.



5.1 Calculate the mechanical energy of the cell phone just before it leaves the woman's hand. (5)

E mech (top) = Ep + Ek

E mech (top) = (m g h) + (½ m v^2)

E mech (top) = (_____ x _____ x _____) + (_____ x _____ x _____)

E mech (top) =

5.2 Calculate the gravitational potential energy of the cell phone 5m above the ground. (3)

Ep = m x g x h (formula)

Ep = x x

Ep =

5.3 The kinetic energy of the cell phone at 5m above the ground. (4)

Emech(top) = Emech (5m)

Insert a value here, _____ = Ep + Ek

(Not a formula) _____ = _____ + Ek

Ek =

5.4 The velocity of the cell phone 5m above the ground. (1)

v = _____