



**KWAZULU-NATAL PROVINCE**

**EDUCATION**  
REPUBLIC OF SOUTH AFRICA



**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**PHYSICAL SCIENCES**

**COMMON TEST**

**MARCH 2022**

Stanmorephysics.com

**TIME:** 1,5 hours

**MARKS:** 75

This question paper consists of 10 pages, two data sheets and a detachable answer sheet for question 2.2.3

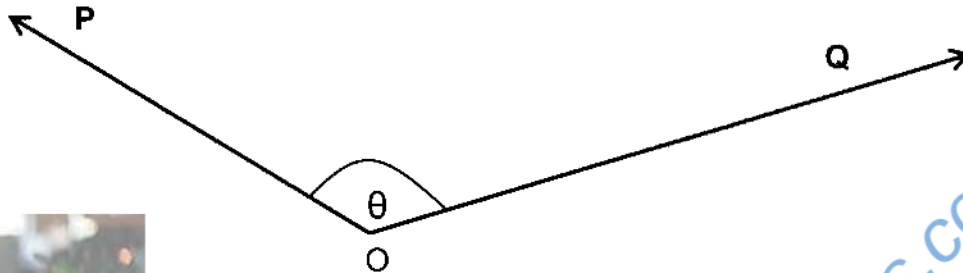
## INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK**.
2. This question paper consists of **SIX** questions. Answer **ALL** the questions in the **ANSWER BOOK**.
3. Start **EACH** question on a **NEW** page in the **ANSWER BOOK**.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave **ONE** line between two subsections, for example between **QUESTION 2.1** and **QUESTION 2.2**.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached **DATA SHEET**.
9. Show **ALL** formulae and substitutions in **ALL** calculations.
10. Round off your final numerical answers to a minimum of **TWO** decimal places.
11. Give brief motivations, discussions, et cetera where required.

**QUESTION 1 : MULTIPLE CHOICE QUESTIONS**

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A - D) next to the question number (1.1 —1.5) in the ANSWER BOOK, for example 1.6 D.

1.1 Two forces P and Q act at the same point O as shown in the sketch below.

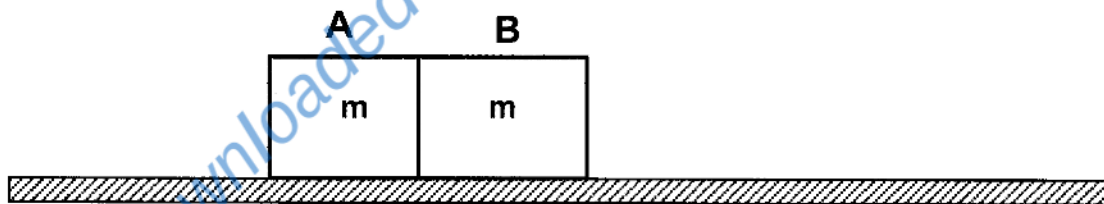


When the angle  $\theta$  between the forces changes, the resultant force obtained is 12 N. If the magnitude of force P is 4 N, which of the forces given below CANNOT be the magnitude of force Q?

- A 8 N
- B 11,31 N
- C 2 N
- D 10 N

(2)

1.2 Two blocks A and B of identical mass  $m$  are in contact with each other on a rough surface. Block B is pushed to the left so that it exerts a force  $F$  on block A.



The force that block A exerts on block B, in terms of  $F$ , is...

- A  $F$ , to the left
- B  $\frac{1}{2} F$ , to the left
- C  $\frac{1}{2} F$ , to the right
- D  $F$ , to the right

(2)

1.3 The gravitational force of attraction between two large masses is  $F$ .  
If the distance between the centres of the masses is doubled, the force between them will be

- A  $\frac{1}{4} F$
- B  $2 F$
- C  $4 F$
- D  $\frac{1}{2} F$  (2)

1.4 Which ONE of the following has a dative covalent bond?

- A  $\text{NH}_3$
- B  $\text{H}_2\text{O}$
- C  $\text{OH}^-$
- D  $\text{NH}_4^+$  (2)

1.5 Which one of the following combinations is correct if the number of bonding electron pairs between two identical atoms is increased?

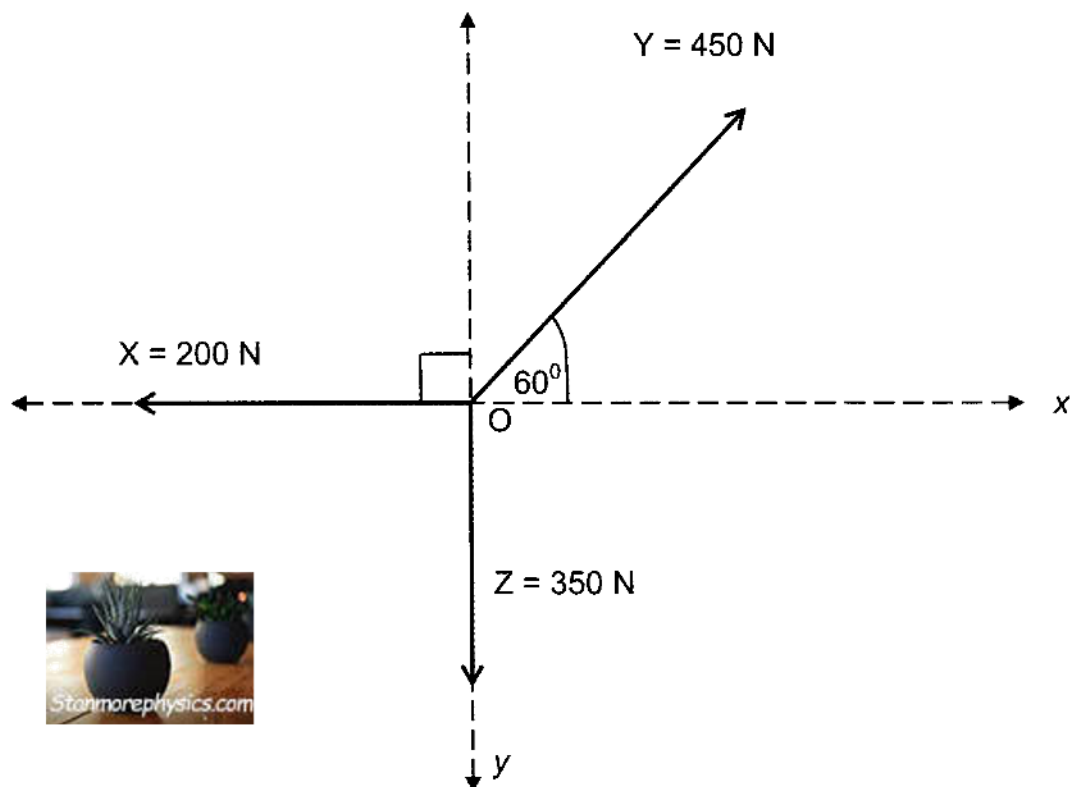
	Bond Length	Bond Energy
A	increases	increases
B	decreases	decreases
C	decreases	increases
D	increases	decreases

(2)

[10]

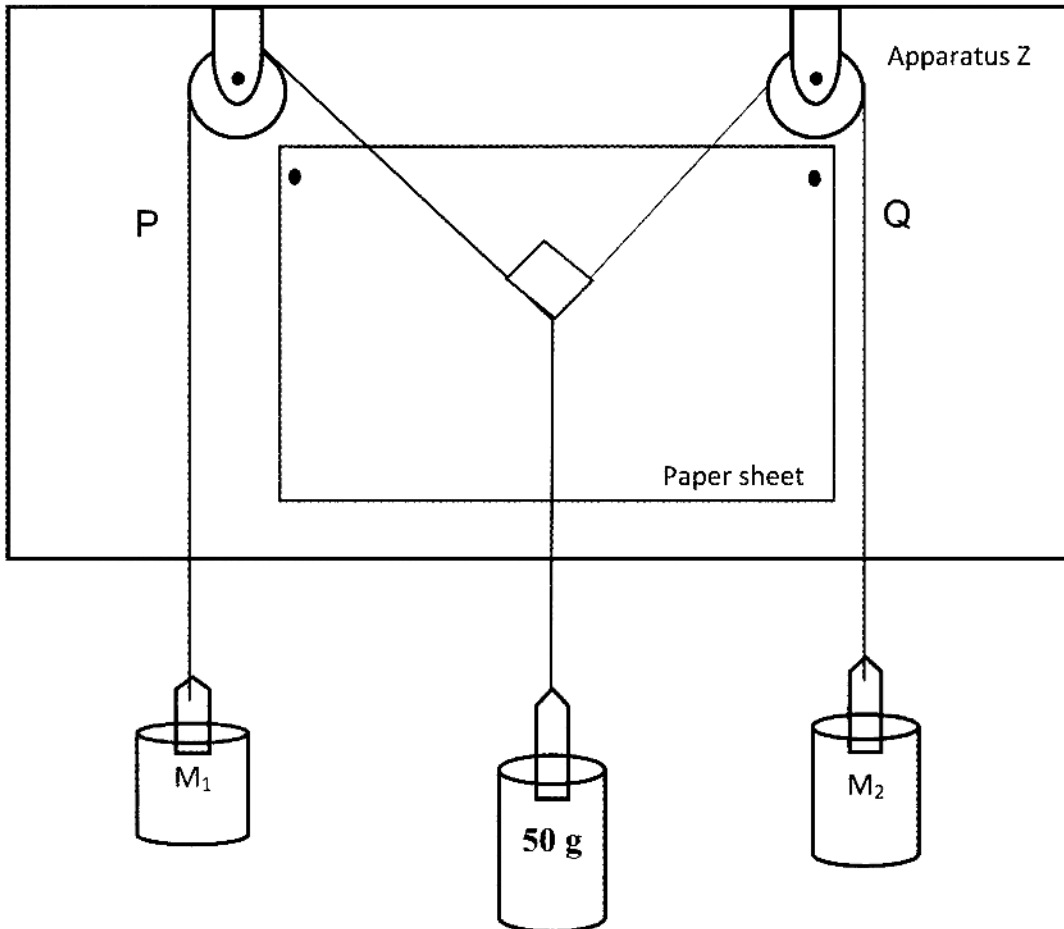
**QUESTION 2**

2.1 Three forces X, Y and Z of magnitudes 200 N, 450 N and 350 N respectively, act at a point O in the directions shown below. The forces are NOT drawn to scale.



- 2.1.1 Define *resultant force*. (2)
- 2.1.2 Calculate the magnitude of the resultant force of these three forces. (5)

2.2 The apparatus shown below was used to determine the resultant of two co-planar forces P and Q.



The angle between the forces P and Q is  $90^\circ$  and the masses  $M_1$  and  $M_2$  are identical.

2.2.1 Name the apparatus, Z, to which the paper sheet is attached. (1)

2.2.2 A learner states that the system is in a state of static equilibrium. State two conditions necessary for this system to remain in this state. (2)

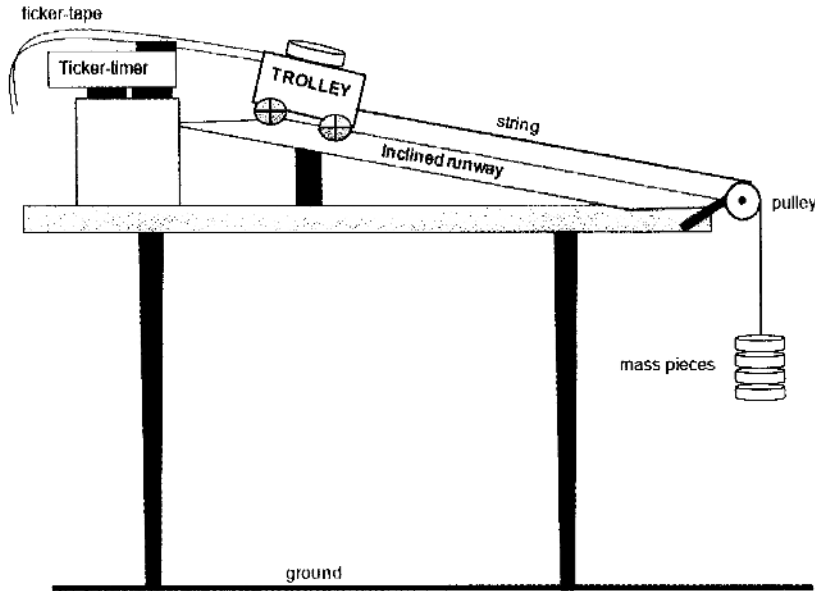
2.2.3 **An incomplete diagram for the results of this investigation is given on page 14 of this question paper.** Complete the diagram using a scale of  $10\text{mm} = 0,1\text{ N}$  and determine the magnitude of the forces P and Q. (4)

2.2.4 The 50 g mass piece is now replaced by an 80 g mass piece. How will this affect the magnitude of the resultant force of P and Q when the system re-establishes a state of static equilibrium? Choose from INCREASES, DECREASES OR REMAINS THE SAME. (2)  
Give a reason for the answer.

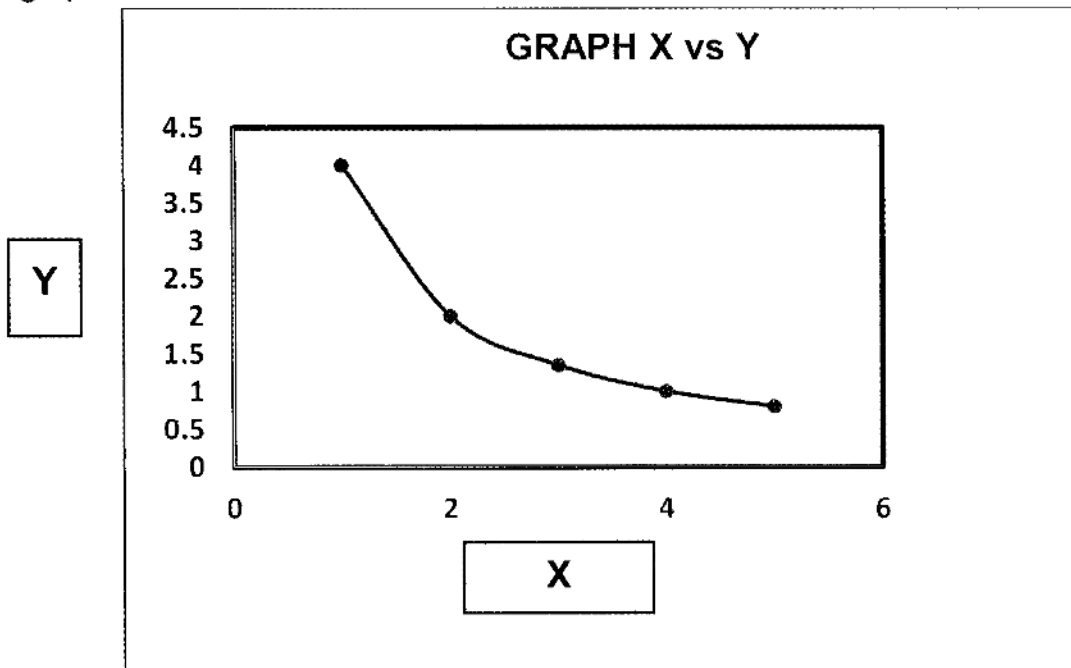
[16]

**QUESTION 3**

The experiment below was used to verify the relationship between acceleration and the mass of an object. Learners set up the apparatus as shown in the diagram below.

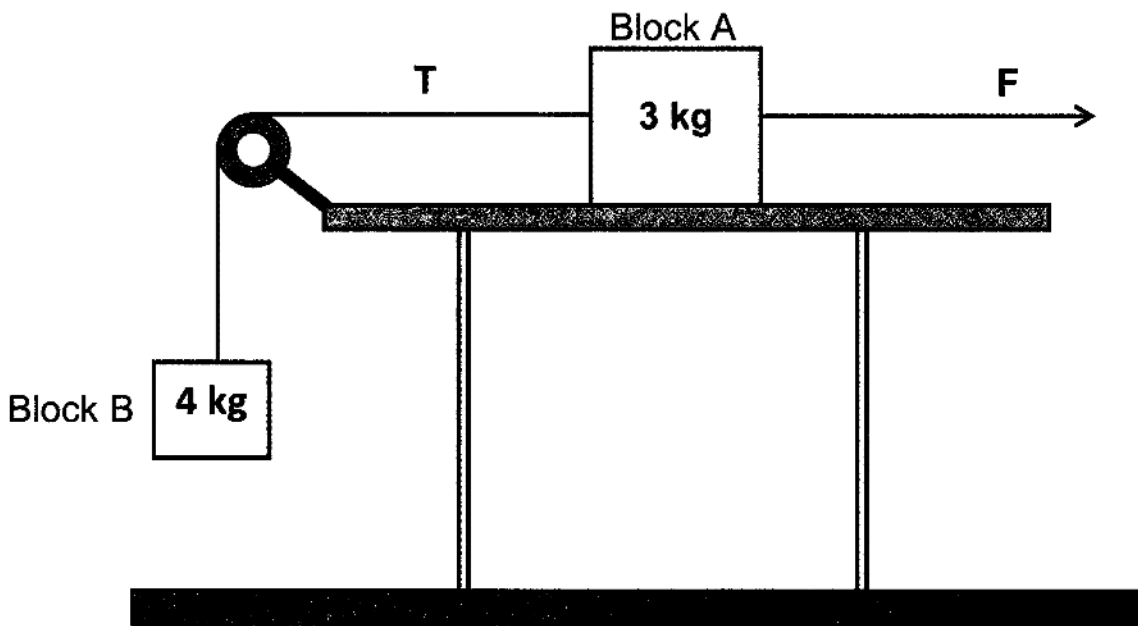


The runway was gently tilted as individual mass pieces were added onto the trolley whilst a constant force acted on the system. The results obtained were used to plot the graph shown.



- 3.1 A learner uses ticker tape to test whether the runway is tilted so that it compensates for friction.  
 How should the spacing of the dots appear on this ticker tape? (1)
- 3.2 Write down the headings with relevant units for labels X and Y. (2)
- 3.3 Determine the constant net force used in this experiment. (3)

- 3.4 State in words the mathematical relationship between the variables X and Y. (1)
- 3.5 Sketch a graph of Y verses  $\frac{1}{X}$ . (no values are needed) (2)
- 3.6 Two blocks, A and B, of masses 3 kg and 4 kg respectively, are attached to each other by means of an inextensible cord. Block A is placed on a rough horizontal surface, while block B hangs over a frictionless pulley. When a horizontal force F is applied to block A, as shown, block A accelerates to the right.



The net force acting on block A is 6 N and the coefficient of kinetic friction for the surface and the block A is 0,025. The tension in the cord is T.

- 3.6.1 Draw a labelled free body diagram for block A. (5)
- 3.6.2 Calculate the magnitude of the acceleration of block B. (3)
- 3.6.3 Calculate the magnitude of force F (6)

**[23]**

#### QUESTION 4

- 4.1 State in words, *Newton's Law of Universal Gravitation*. (2)
- 4.2 Calculate the magnitude of the gravitational force that the Moon exerts on the Earth if the distance between their centres is  $3.86 \times 10^8$  m. (4)  
The Moon has a mass of  $7.34 \times 10^{22}$  kg.

**[6]**



**QUESTION 5**

Consider the following molecules and answer the questions that follow:

A	B	C	D	E
<b>SO<sub>2</sub></b>	<b>HCl</b>	<b>H<sub>2</sub></b>	<b>HOCl</b>	<b>H<sub>2</sub>O</b>

5.1 Consider molecule **A**:

5.1.1 Draw the Lewis Dot structure. (2)

5.1.2 Name the type of bonding between the atoms of molecule A. (2)  
Give a reason for the answer.

5.2 Write down the NAME or FORMULA of a non-polar molecule from the list above. (1)

5.3 Is the bond in molecule **B** POLAR or NON-POLAR? (3)  
Explain your answer with the aid of a relevant calculation.

5.4 For molecule **D** state the total number of:

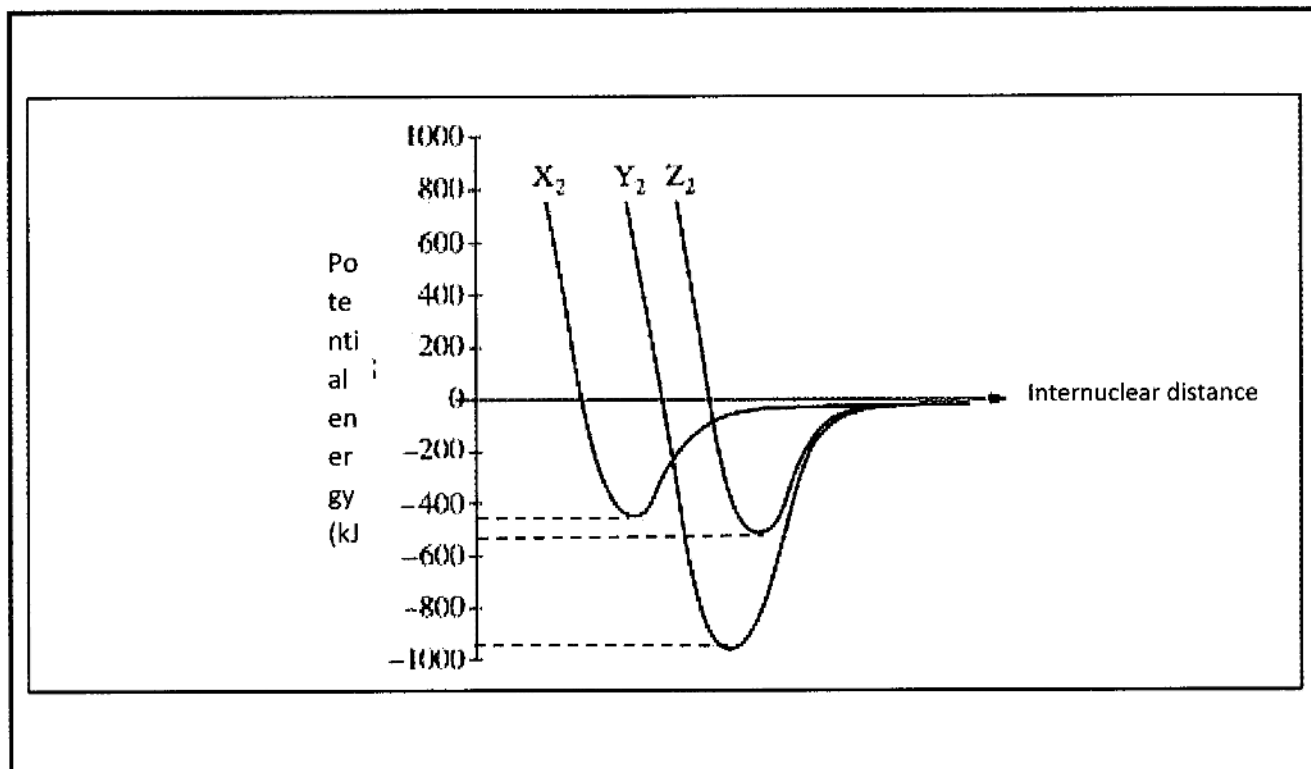
5.4.1 bonding electron pairs (1)

5.4.2 lone pairs (1)

**[10]**

**QUESTION 6**

The following graphs represent bond formation in diatomic molecules  $N_2$ ,  $O_2$  and  $H_2$  in random order. Study the graphs below and answer the questions that follow.



- 6.1 Define the term *bond energy*. (2)
- 6.2 Identify the graph that represents the  $N_2$  molecule. Choose from  $X_2$ ,  $Y_2$  or  $Z_2$ . (1)
- 6.3 Explain the answer to question 6.2. (3)
- 6.4 Write down the value of the bond energy for the  $H_2$  molecule. (1)
- 6.5 Which molecule has the longest bond length? Choose from  $X_2$ ,  $Y_2$  or  $Z_2$ . (1)
- 6.6 Arrange molecules  $X_2$ ,  $Y_2$  and  $Z_2$  in terms of increasing bond order. (2)

**[10]**

**TOTAL :75**

## DATA SHEET

### PHYSICS:

**TABLE 1: PHYSICAL CONSTANTS**

NAME	SYMBOL	VALUE
Acceleration due to gravity	$g$	$9,8 \text{ m}\cdot\text{s}^{-2}$
Universal gravitational constant	$G$	$6,67 \times 10^{-11} \text{ N}\cdot\text{m}^2\cdot\text{kg}^{-2}$
Radius of the Earth	$R_E$	$6,4 \times 10^6 \text{ m}$
Mass of the Earth	$M_E$	$5,98 \times 10^{24} \text{ kg}$

**TABLE 2: FORMULAE**

#### MOTION

$v_f = v_i + a \Delta t$	$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ or $\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left( \frac{v_i + v_f}{2} \right) \Delta t$ or $\Delta y = \left( \frac{v_i + v_f}{2} \right) \Delta t$

#### FORCE

$F_{\text{net}} = ma$	$p = mv$
$f_s^{\text{max}} = \mu_s N$	$f_k = \mu_k N$
$F_{\text{net}} \Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G \frac{m_1 m_2}{d^2}$ or $F = G \frac{m_1 m_2}{r^2}$	$g = G \frac{M}{d^2}$ or $g = G \frac{M}{r^2}$

**TABLE 3: THE PERIODIC TABLE OF ELEMENTS**

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	(I)													(III)	(IV)	(V)	(VI)	(VII)	(VIII)	
2,1	1	<b>H</b> 1																		<b>He</b> 2
1,0	3	<b>Li</b> 7	<b>Be</b> 9															<b>F</b> 19	<b>Ne</b> 20	
0,9	11	<b>Na</b> 23	<b>Mg</b> 24															<b>Cl</b> 35,5	<b>Ar</b> 40	
0,8	19	<b>K</b> 39	<b>Ca</b> 40	<b>Sc</b> 45	<b>Ti</b> 48	<b>V</b> 51	<b>Cr</b> 52	<b>Mn</b> 55	<b>Fe</b> 56	<b>Co</b> 59	<b>Ni</b> 59	<b>Cu</b> 63,5	<b>Zn</b> 65	<b>Ga</b> 70	<b>Ge</b> 73	<b>As</b> 75	<b>Se</b> 79	<b>Br</b> 80	<b>Kr</b> 84	
0,8	37	<b>Rb</b> 86	<b>Sr</b> 88	<b>Y</b> 89	<b>Zr</b> 91	<b>Nb</b> 92	<b>Mo</b> 96	<b>Tc</b> 101	<b>Ru</b> 101	<b>Rh</b> 103	<b>Pd</b> 106	<b>Ag</b> 108	<b>Cd</b> 112	<b>In</b> 115	<b>Sn</b> 119	<b>Sb</b> 122	<b>Te</b> 128	<b>I</b> 127	<b>Xe</b> 131	
0,7	55	<b>Cs</b> 133	<b>Ba</b> 137	<b>La</b> 139	<b>Hf</b> 179	<b>Ta</b> 181	<b>W</b> 184	<b>Re</b> 186	<b>Os</b> 190	<b>Ir</b> 192	<b>Pt</b> 195	<b>Au</b> 197	<b>Hg</b> 201	<b>Tl</b> 204	<b>Pb</b> 207	<b>Bi</b> 209	<b>Po</b> 209	<b>At</b> 210	<b>Rn</b> 222	
0,7	87	<b>Fr</b> 226	<b>Ra</b> 226	<b>Ac</b> 227																

**KEYISLEUTEL**

Atomic number  
Atoomgetal

Electronegativity  
Elektronegatiwiteit

Symbol  
Simbool

Approximate relative atomic mass  
Benaderde relatiewe atoommassa

58	59	60	61	62	63	64	65	66	67	68	69	70	71
<b>Ce</b> 140	<b>Pr</b> 141	<b>Nd</b> 144	<b>Pm</b>	<b>Sm</b> 150	<b>Eu</b> 152	<b>Gd</b> 157	<b>Tb</b> 159	<b>Dy</b> 163	<b>Ho</b> 165	<b>Er</b> 167	<b>Tm</b> 169	<b>Yb</b> 173	<b>Lu</b> 175
<b>Th</b> 232	<b>Pa</b> 231	<b>U</b> 238	<b>Np</b> 237	<b>Pu</b> 242	<b>Am</b> 243	<b>Cm</b> 247	<b>Bk</b> 247	<b>Cf</b> 251	<b>Es</b> 252	<b>Fm</b> 257	<b>Md</b> 288	<b>No</b> 289	<b>Lr</b> 260

**DETACH THIS PAGE**



**NAME OF LEARNER :** \_\_\_\_\_

**Question 2.2.3**

