SUBJECT and GRADE	PHYSICAL SCIENCES GRADE 10	
TERM 3	WEEK 5	
TOPIC	MECHANICS – VECTORS AND SCALARS	
AIMS OF LESSON	To introduce the concepts of VECTORS and SCALARS To CLASSIFY Physical Quantities as Vectors or Scalars To learn and remember the Properties of Vectors	
RESOURCES	***Paper based resources***	***Digital resources***
	Refer to your own textbook and check the index for the Module: MECHANICS. Read and do the activity in your book for this section of work.	Refer to the relevant digital resources e.g. links on the WCED ePortal: https://www.wcedeportal.co.za **Watch the video on Youtube -** Intro to vectors & scalars | One-dimensional motion | Physics | Khan Academy – link **https://www.youtube.com/watch?v=ihNZlp7iUHE**
INTRODUCTION	We are now starting with MECHANICS and MECHANICS is the section of Physics that deals with the study of Motion (Kinematics) and the Forces that cause motion (Dynamics). Many of us rely on transport to get to school each day **and** we use many different machines to perform many tasks for us. When we study Mechanics, we will focus on the interactions between matter and the forces on it. We use these principles to design machines, cars, taxis and buses and even to understand how the Earth orbits the Sun. It is important, therefore, to have knowledge of Physical Quantities because technology is constantly improving. A physical quantity is a measurable property of something that we find in nature. If we measure something and the changes it undergoes, we understand more about it. Physical quantities are divided into scalar quantities or vector quantities.	

CONCEPTS AND SKILLS

PART 1

SCALAR QUANTITIES:
Scalars are physical quantities that have magnitude (size) only (NO DIRECTION).

EXAMPLES:

QUANTITY	SYMBOL	SI UNIT
time	t	seconds (s)
mass	m	kilogram (kg)
temperature	T	Degrees Celsius (ºC)
distance	D	meter (m)
speed	v	meter per second ($m \cdot s^{-1}$)

VECTOR QUANTITIES:
Vectors are physical quantities that have both magnitude (size) **and** direction.

EXAMPLES:

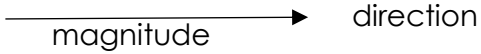
QUANTITY	SYMBOL	SI UNIT
Force	F	Newton (N)
weight	F_g or w	Newton (N)
displacement	Δx or Δy	meter (m)
velocity	v	meter per second ($m \cdot s^{-1}$)
acceleration	a	meter per second squared ($m \cdot s^{-2}$)

COMPLETE ACTIVITY 1 in your Notebook.

PART 2

HOW TO DRAW VECTORS – THE GRAPHICAL REPRESENTATION OF VECTORS

The magnitude and direction of vector quantities can be represented by means of a vector diagram (an arrow).
The length of the arrow indicates the magnitude (size) of the quantity and the arrowhead indicates the direction of the quantity.



CAN YOU?

Identify quantities as Scalars or Vectors?

Draw vectors? For example, you cannot draw 100 km on your page and therefore you use a scale to make it smaller so that you can draw it on your page.

EXAMPLES:

Use a scale of 10 mm: = 10 m in order to draw:

1. 50 m South
2. 75 m East

Solutions:

1. 50 m = 50 mm

2. 75 m = 75 mm

COMPLETE ACTIVITY 2 in your Notebook.

PART 3

PROPERTIES OF VECTORS

1. Two vectors are equal if they have the same magnitude and the same direction. For example, 100 N, west = 100 N, west
2. Positive vectors point in a positive direction and negative vectors point in the opposite direction for example, North and South, if you choose North as the positive direction then South will be the negative direction.
3. We add vectors in a straight line using the sign conventions: (for example right is positive and left is negative OR north is positive and south is negative) but NEVER combine right and North etc.

PART 4

DIFFERENTIATE BETWEEN SCALAR AND VECTOR QUANTITIES

Scalar quantities can be added and subtracted just like ordinary numbers. If we place 3 apples in a bowl and then add 3 more apples there will be 5 apples in the bowl. However, when we add vectors the direction of each vector makes a difference. If two people push on a door in the same direction the effect is not the same as if they push in opposite directions. With vectors we must consider their direction.

EXAMPLES:

SCALAR QUANTITIES	VECTOR QUANTITIES
Adding Scalars: (Only the sum is determined, direction is not considered) (a) 10 kg + 15 kg = 25 kg The mass of two children is 25 kg (b) 2 km + 2 km + 1 km = 5 km This is the <u>total</u> distance walked by a girl from home to school.	Adding Vectors: (Directions of vectors must be considered) (a) 3 m East + 2 m West = 1m East (+3 m) + (-2 m) = (+1 m) The 2m West is in the opposite direction, that is why it is subtracted. (b) 3 m East + 2 m East = 5 m East The distances are in the same direction, so it is added.

<table>
<tr><td>ACTIVITIES/
ASSESSMENT</td><td>
<u>ACTIVITY 1:</u>
Copy the Table into your Notebook and complete it.
<table>
<tr><th>NO.</th><th>QUANTITY</th><th>VECTOR OR SCALAR</th><th>MAGNITUDE</th><th>DIRECTION</th></tr>
<tr><td>1.1</td><td>36 degrees Celsius ((ºC)</td><td></td><td></td><td></td></tr>
<tr><td>1.2</td><td>23 cm</td><td></td><td></td><td></td></tr>
<tr><td>1.3</td><td>60 kilometers per hour ($km \cdot h^{-1}$)</td><td></td><td></td><td></td></tr>
<tr><td>1.4</td><td>60 $km \cdot h^{-1}$, SOUTH</td><td></td><td></td><td></td></tr>
<tr><td>1.5</td><td>250 grams (g)</td><td></td><td></td><td></td></tr>
<tr><td>1.6</td><td>Running 5 steps forward</td><td></td><td></td><td></td></tr>
<tr><td>1.7</td><td>Your weight of 550 N</td><td></td><td></td><td></td></tr>
</table>

<u>ACTIVITY 2</u>
In this practical activity you will draw to scale a 400 N force that acts upwards.
<u>INSTRUCTIONS</u>
1. Indicate the reference direction: Small arrow up.
2. Decide on a suitable scale, for example, 1 mm: 10 N.
3. Draw the vector to scale in the correct direction. Its length is 40 mm for a scale of 1 mm: 10 N.
4. Write the scale on the drawing.
5. Show the direction of the vector with an arrowhead.
6. Label the vector to identify it, give its magnitude (size) and direction.
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<tr><td>CONSOLIDATION</td><td>
• You can now identify Physical quantities as Scalar or Vectors quantities.
• You should be able to draw vectors by using a scale, using the length of the arrow to indicate the magnitude (size) and the arrowhead to indicate the direction of the quantity.
• You must be able to add vectors acting in the same direction and in opposite directions.
• Good luck with the lesson!
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<tr><td>VALUES</td><td>ATTENTIVENESS and INDEPENDENCE are the values specific for the lesson, you must follow the rules and learn to work on your own.</td></tr>
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