**Science Reviewer**

**Forces and Motion**

**Definition of Terms:**

* **Measurement** – A way of comparing certain attribute of an object.
* **Direct Measurement** – Taking a measurement using standard tools or instruments **directly on the object** being measured.
* Measuring the **length of a table** using a **ruler or tape measure**.
* Measuring **temperature** using a **thermometer**.
* Measuring **mass** using a **weighing scale**.
* Measuring **time** using a **stopwatch** or **clock**.
* Measuring **voltage** directly with a **voltmeter**.
* **Indirect Measurement** – Obtaining a measurement by **calculating or estimating** it using formulas, proportions or comparisons, especially when direct measurement is not possible.
* Finding the **height of a building** by using **shadow le**ngth and **applying similar triangles**.
* Measuring the **distance across a river** by applying **trigonometry** (e.g., using the Law of Sines).
* Calculating **area or volume** using measurements of length and width (e.g., area = length × width).
* Estimating **the speed of a moving** object using **distance ÷ time**.
* Using **Pythagorean Theorem** to find the diagonal of a **rectangle** when only length and width are measured.
* **Graphical Methods** – Graphical methods involve **drawing** vectors **to scale** and using **geometry** to find results.
* **Analytical Methods** – Analytical methods use **mathematical formulas** to calculate magnitude and direction of vectors.

**Physical Quantities:**

* **Scalar** – **A scalar** is a quantity that is described by **magnitude only** (just a number and unit, no direction).
* Speed (e.g., 60 km/h)
* Mass (e.g., 5 kg)
* Temperature (e.g., 30°C)
* Time (e.g., 10 seconds)
* **Vector** – **A** **vector** is a **quantity** that both **magnitude and direction.**
* Velocity (e.g., 60 km/h north)
* Force (e.g., 10 N to the right)
* Acceleration (e.g., 5 m/s² upward)
* Displacement (e.g., 20 meters east)
* **Resultant** – A **resultant** **vector** is a **single** **vector** that has the **same** **effect** as **two** or **more** **vectors** **combined**.
* If you walk 3 meters north and then 4 meters east, your **resultant displacement** is the **diagonal** between those two directions — found using the **Pythagorean Theorem**:

* **Arrow** –An arrow is used to represent a vector.
* **Length** – **Magnitude** (how big or strong the quantity is). A longer arrow means a greater value.
* **Direction the Arrow Points** – Direction of the vector. For example, an arrow pointing up shows upward force or movement.
* **Tail** – Starting point of the vector
* **Head** – Direction where the vector ends or acts.

**How to Read Compass-Based Angles:**

* In physics and navigation, directions are often given in the form:
* This structure provides both **magnitude of deviation** (in degrees) and a **reference axis** (cardinal direction). To correctly interpret this kind of direction, it's important to understand what each part of the phrase signifies.
* When you hear something like “**25 degrees North of East**,” it means you start from **the East direction** and then turn **25 degrees toward the Nort**h. You're not starting from the North — you're moving from East in the direction **toward North**.
* All angles are measured **counterclockwise from East**, unless otherwise specified.
* How to Interpret the Direction:
* **Step 1**: **Identify the base direction** (the one after the word "of"). This is your starting axis.
* **Step** 2: Locate **the angle** and determine how far to rotate.
* **Step** 3: Determine **the direction of rotation** toward the first direction (the one before "of").
* **Step** 4: Apply **the angle rotation** starting from the base direction, toward the specified direction.
* **Step 5:** The result is a unique direction somewhere between the base and the turn direction.

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| * **General Format** - [angle] [direction 1] of [direction 2] * This means **you start from [Direction 2]**, then **rotate [X degrees] toward [Direction 1]**. * If you are turning **clockwise** from the base direction, you **add** the angle to the base direction. * If you are turning **counterclockwise** from the base direction, you **subtract** the angle from the base direction. | | **Direction:** | **Angle:** |
| **Example 1:** 25° North of East   * Start from **East** (90°) * Turn **25° toward North** (upward) * Final angle = | **Example:** 30° East of North   * Start from **North** (0°) * Turn **30° toward East** (right) * Final angle = | East | 0° or 360° |
| North | 90° |
| West | 180° |
| South | 270° |

**Graphical Method:**

* **Triangle Method** - Vectors are placed head-to-tail; the resultant connects start to end.
* **Step 1:** Draw the first vector to scale in the correct direction.
* **Step 2**: At the **tip of the first**, draw the second vector starting from there.
* **Step 3**: Draw the **resultant vector** (R) from the **start of the first** to the **end of the second**.
* **Step 4**: Measure length and angle of resultant (if needed).

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| **Example:** |