SUBJECT and GRADE	**Physical Sciences Grade 12**
TERM 2	*Week 1 & 2*
TOPIC	Work-Energy
AIMS OF LESSON	Learners should be able to solve problems involving: • Work done by a force OR the net force • The work-energy theorem • Conservation of mechanical energy • Power
INTRODUCTION	To solve Work-Energy problems you MUST have a clear understanding of Newton's 1st and 2nd Laws done in grade 11. Ensure you are able to draw force-diagrams and free-body diagrams and solve problems for different situations. For example: • A stationery object on a horizontal surface, on an incline or hanging from a rope. • An object moving vertically upwards or downwards, with or without an applied force. • An object moving on a horizontal surface: ✓ with or without a force applied to it. ✓ with a force applied horizontally or at an angle to the horizontal plane. ✓ with a force applied in a direction opposite to the direction of motion. ✓ In the presence or in the absence of friction. • An object moving on an inclined surface: ✓ with or without a force applied to it. ✓ with a force applied in a direction opposite to the direction of motion. ✓ in the presence or in the absence of friction. (Mind the Gap – Unit 1, p.2 – 26)

CONCEPTS AND SKILLS	**Work** • Define the work done on an object by a constant force F as $F\Delta x \cos\theta$ where: F is the magnitude of the force; Δx is the magnitude of the displacement; and θ is the angle between the force and the displacement. (Work is done by a force. The use of the phrase 'work is done against a force', e.g. work done against friction, must be avoided). • Draw force diagrams and free-body diagrams. • Calculate the net work done on an object. • Distinguish between positive net work done and negative net work done on a system. **Work-Energy Theorem** • State the work-energy theorem: The net work done on an object is equal to the change in the object's kinetic energy. OR The work done on an object by a net force is equal to the change in the object's kinetic energy. o In symbols: $Wnet = K = Kf - Ki$. • Apply the work-energy theorem to objects on horizontal, vertical and inclined planes (for both frictionless and rough surfaces). **Conservation of energy with non-conservative forces present** • Define a conservative force as a force for which the work done in moving an object between two points is independent of the path taken. Examples are gravitational force, the elastic force in a spring and electrostatic forces (coulomb forces). • Define a non-conservative force as a force for which the work done in moving an object between two points depends on the path taken. Examples are frictional force, air resistance, tension in a chord, etc. • State the principle of conservation of mechanical energy: The total mechanical energy (sum of gravitational potential energy and kinetic energy) in an isolated system remains constant. o A system is isolated when the net external force acting on the system is zero. • Solve conservation of energy problems using the equation: $Wnc = \Delta Ek + \Delta Ep$ • Use the relationship above to show that, in the absence of non-conservative forces, mechanical energy is conserved. **Power** • Define power as the rate at which work is done or energy is expended.

	In symbols: P = W/Δt • Calculate the power involved when work is done. • Perform calculations using $P_{ave} = Fv_{ave}$ when an object moves at a constant speed along a rough horizontal surface or a rough inclined plane. • Calculate the power output for a pump lifting a mass, e.g. lifting water through a height at constant speed.
ACTIVITIES/ ASSESSMENT	• Power point – Ctrl + Click on the following link: https://docs.google.com/presentation/d/1WC1gDK3sBakYqgM-Z9-t6-zPpTnRN3CxgLrHSTH1vXk/edit?usp=sharing Study the presentation and work through Activities 1 & 2. • Worksheet – Ctrl+ Click on the following link: https://docs.google.com/document/d/10Szg8K2KgKedKt2VL2y7TkwD6aE2pZwWqklrMT4fRpc/edit?usp=sharing Try to solve Activities 1 and 2 without referring to the answers in the Power point. • Worksheet – Ctrl + click on the following link: https://bit.ly/3aWp9Vt Try to solve the problems without the memorandum • Memorandum – Ctrl+ click on the following link: https://bit.ly/2Rob5MW • Learners are referred to Work-Energy activities/assessment that they can complete/do in their Physical Sciences textbooks or Study guides. • Informal assessment activities in Mind the Gap: Work-Energy and Power, Activities 1-10 (page 68-80).

<table>
<tr><td>CONSOLIDATION</td><td colspan="2">• Work is a scalar quantity and therefore does not have a direction.
• The measuring unit of work is Joule. The symbol of Joule is J.
• Net Work is the sum of all work done on an object.
• Net Work is done by a Net Force.
• Positive work is the work done on an object to move it in the direction of the force (or component of the force).
Positive work increases the kinetic energy of an object.
• Negative work is the work done by an opposing force. Negative work decreases the kinetic energy of an object.
• Work done by the man is positive.
• Work done by the friction is negative.</td></tr>
<tr><td rowspan="2">RESOURCES</td><td>Paper based resources</td><td>Digital resources</td></tr>
<tr><td>Learners are referred to the:
• DBE WE and Power notes. Link: https://bit.ly/34ojwNi
• Work-Energy topic in the textbook or study guides (e.g. Answer Series) that learners will have on hand.
• Examination Guideline (page 10-11)
• Mind the Gap books (pages 68-80)
• Past NSC Examination papers (refer to Paper 1 question 5)</td><td>Refer to the relevant digital resources:
• WCED ePortal
• HeyScience App for Physical Sciences
• Past NSC Examination papers (refer to Paper 1, question 5)
• www.siyavula.com
• Science Clinic
• Papervideo</td></tr>
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