

Unit 3

Work, Power, Kinetic Energy, and Mechanical Energy

SOURCE LOCK

Built from SPH3U video-distilled notes. Teacher moves, examples, and practice prompts are pulled from the local distilled packets.

Big idea

- Energy methods replace detailed force-by-force motion tracking with a before-and-after comparison when the model fits.

Lesson map

- Work and power - 5 source lessons
- Power and acceleration contexts - 3 source lessons
- Work-energy theorem - 8 source lessons
- Mechanical energy conservation - 8 source lessons

Core Notes

What to know

- Work depends on the force component along displacement.
- Positive and negative work describe whether a force supports or opposes the motion.
- Power describes the rate of doing work or transferring energy.
- The work-energy theorem connects net work to change in kinetic energy.
- Mechanical energy conservation works when non-conservative energy transfer is absent or accounted for.

Problem-solving workflow

- Decide whether the question is asking for work, power, work-energy theorem, or conservation.
- Mark the initial state and final state.
- List kinetic energy, gravitational potential energy, elastic potential energy, and external work as needed.
- Write the energy equation before substituting numbers.
- Check whether friction, engine power, or another non-conservative process changes the total mechanical energy.

Common traps

- Do not treat all forces as doing positive work.
- Do not use energy conservation when the source problem includes energy loss unless that loss is included.
- For power-start problems, keep force, velocity, and power relationships distinct.
- Do not confuse the work-energy theorem with a force-balance equation.

Teacher Moves

HOW TO THINK

These notes preserve the teacher's problem-solving moves: how to decide the model before calculating.

Move 1

- Draw the free-body diagram before writing force equations. | Source: L100 00:06:21, L103 00:09:42, L104 00:03:12.

Move 2

- Use net work to track the change in kinetic energy. | Source: L107 00:00:10, L108 00:00:29, L112 00:05:19.

Move 3

- Read the graph feature first: slope, area, intercept, or trend. | Source: L102 00:01:18, L104 00:12:31, L105 00:01:58.

Move 4

- Keep power, force, and velocity relationships distinct in car-start problems. | Source: L103 00:00:13, L104 00:00:41, L105 00:00:21.

Move 5

- Connect spring force to deformation and restoring direction. | Source: L115 00:07:49, L117 00:04:44, L120 00:03:53.

Move 6

- Choose a positive direction and keep every vector sign consistent. | Source: L101 00:01:23.

Move 7

Move 7

- For equilibrium, set net force to zero and use geometry or components. | Source: L105 00:00:39.

Move 8

- Decide friction direction from relative motion or tendency of relative motion. | Source: L113 00:03:56.

Move 9

- Use energy-transfer language for thermal review instead of inventing missing formulas. | Source: L118 00:02:14.

Move 10

- Use mechanical energy conservation only when energy loss or external work is absent or included. | Source: L119 00:08:52.

Worked Examples

Distilled example patterns

Work-energy theorem (Unit 3 distilled pattern: net work changes kinetic energy)

Write $W_{\text{net}} = \Delta E_k$.

For an object starting from rest, initial kinetic energy is 0.

If $W_{\text{net}} = 50 \text{ J}$, then final kinetic energy is 50 J.

Use $E_k = 1/2 mv^2$ if speed is requested.

Answer pattern: Final kinetic energy is 50 J before any speed conversion.

Mechanical energy before and after (Unit 3 distilled pattern: compare state 1 and state 2)

Write the energy types present in the initial state.

Write the energy types present in the final state.

If mechanical energy is conserved, set initial total equal to final total.

Practice prompts

- Decide whether work is positive, negative, or zero.
- Use the work-energy theorem for a multi-stage motion.
- Compare constant-power and constant-acceleration car-start patterns.

Source quality note

OCR review flags in this unit: 0 / 1111.

Printed slide text is usually reliable; dense handwritten equations should be verified against source frames.

This packet is polished for student reading, but it keeps the source trace instead of inventing missing formulas.