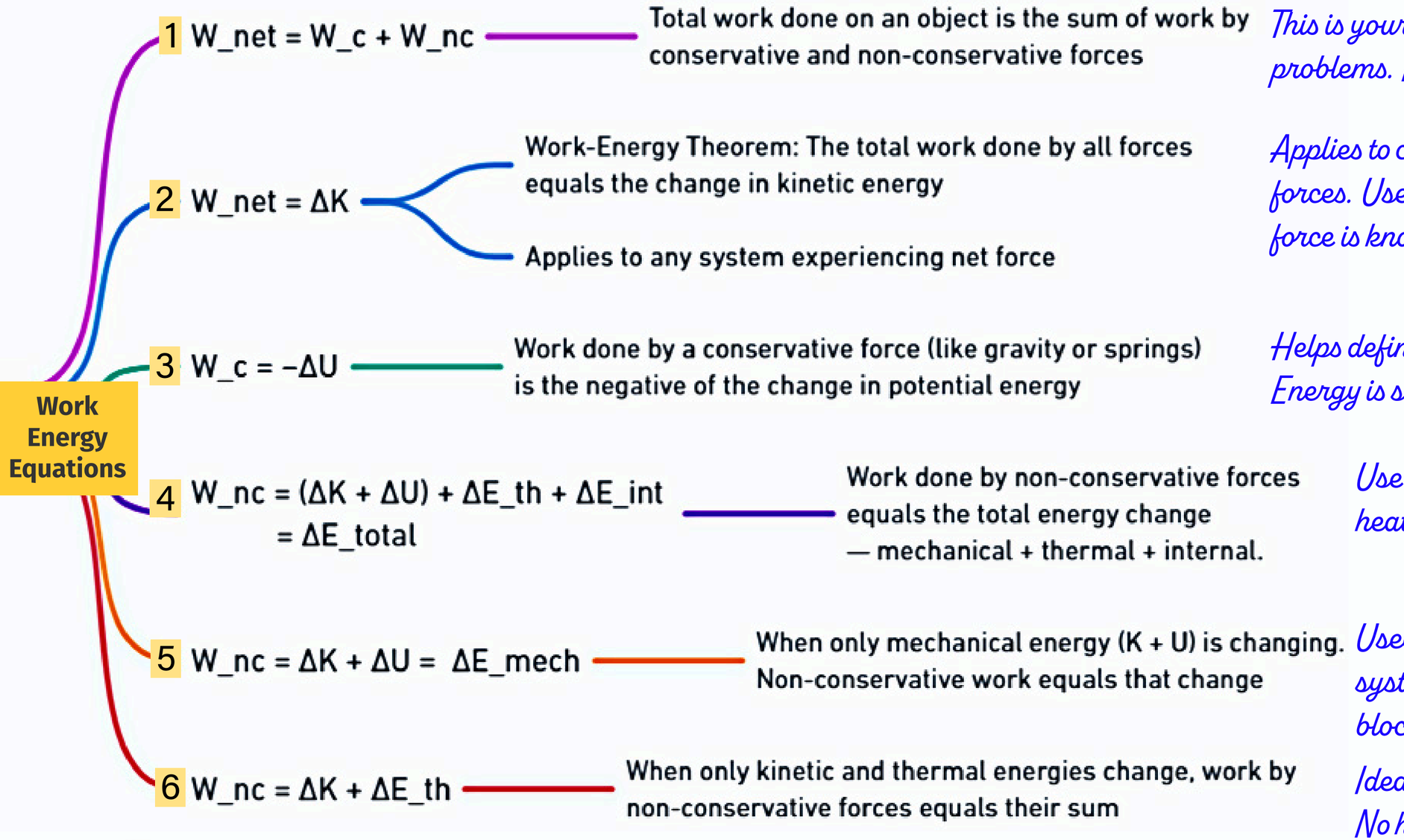
11. Mind Map: Work Energy Equations



This is your 'starting point' for all work-energy problems. Identify the forces & classify them first

Applies to conservative & non-conservative forces. Use this to calculate vel. or acc.when force is known

Helps define potential energy functions. Energy is stored and can be fully recovered

Use this when friction, deformation, or heating is involved. It's your energy 'ledger

Used when energy is added/taken from a system — like throwing a ball or pulling a block with a rope.

Ideal for friction problems on flat surfaces. No height or spring change here

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See full glossary of terms for W_c , W_nc, E_int. etc. on the next slide

Steps for Solving Work-Energy Problems

Step 1 *Identify all Forces Acting. List every force in the system — gravity, normal, friction, tension, push/pull, spring, etc.*

Step 2 *Classify Forces as Conservative or Non-Conservative. Ask: Can this force store and return energy?*
Conservative: Gravity, spring force
Non-conservative: Friction, air resistance, engine force, push/pull by a person

Step 3 *Choose the Most Appropriate Energy Equation. Based on what's happening in the system (e.g., is there friction? a spring?), decide:*

- *Use $W_{net} = \Delta K$ for pure motion problems*
- *Use $W_{nc} = \Delta K + \Delta U$ if an external force changes mechanical energy*
- *Use $W_{nc} = \Delta K + \Delta E_{th}$ if friction is involved*
- *Use $W_{nc} = \Delta E_{total}$ for a complete energy breakdown*

Step 4 *Track Energy Gains and Losses Visually. What energy is gained (e.g., KE ↑)? What energy is lost (e.g., E_{th} ↑ due to friction)?*

Step 5 *Interpret the Result Physically. Ask: Does this answer make sense? Is the object speeding up or slowing down? Was energy conserved, or was some lost to heat/friction?*

Glossary of Terms

1. W_net → Total work done by all forces
2. W_c → Work done by conservative forces (like gravity or springs)
3. W_nc → Work done by non-conservative forces (like friction or air drag)
4. ΔK → Change in kinetic energy
5. ΔU → Change in potential energy
6. ΔE_mech → Change in mechanical energy (ΔK + ΔU)
7. ΔE_th → Change in thermal energy (due to friction or heat loss)
8. ΔE_int → Change in internal energy (like deformation, vibration, or internal heat)
9. ΔE_total → Total change in all energy forms
10. E_mech → Mechanical energy (K + U)