Main things to get ready for one the exam!

Forces

Checklist

- **Free Body Diagram**: some of you still don't do this and miss some problems! Practice this is you have trouble!
- **Break into Components**: usually breaking into the components of acceleration, like problem B on worksheet, have components go up the ramp with the acceleration. If one direction has a sin, the other needs a sin, always, no exception. Draw the components in if it's easier for you
- $\boldsymbol{\Sigma F = ma}$ The forces you sum are ONLY the forces on the FBD, the mass is ONLY the mass of the object you did the FBD for, the acceleration is the a for that object

Big note: ma and $m\frac{v^2}{r}$ are resultant forces; they are the stuff you set equal to for your sum of your forces. There is no "real" centripedal force, only the centripedal force caused by the real forces on your free body diagram. When I have an (a) on my diagrams, thats to only help know which way to define as positive and negative, it isn't a real force!

Types of Forces

- **Gravity: mg**: Always downward. On ramps you'll have to break it into components!
- **Tension**: Always in direction of rope going away from the object. It can pull, not push (ropes don't push...)
- **Normal**: Always away from solid object. This is a force to stop things from going through other solid things. Gravity acts on a block, why doesn't it accelerate downwards? It can't move through the table, so normal force. This is why the force acts away from the solid object
- **Friction:** μN: Always opposite of velocity (not acceleration!). Also, beware! The equation is μN, not μmg!! Normal force can change, so friction will change as well
- **Pushes and Pulls**: These are the grab bag forces. The problem will tell you everything you need to know about these forces.

Aside on Friction

There are two types of friction, kinetic and static. Kinetic is always constant. Static is the friction that keeps an object from moving so it is **whatever it needs to be to keep the object still**.

$$f_k = \mu_k N$$
$$f_s = F_{opposing} \qquad \text{if static friction isn't overcome}$$
$$f_s^{MAX} = \mu_s N$$

Energy

What types of Energy?

- **Kinetic**: Is the object moving?
- **Gravitational Potential**: Is the object losing or gaining height?
- **Spring Potential**: Is there a spring, and is it being stretched?
- **Non-Conservative Forces**: Is something giving/taking energy?

For the kinetic and potential energies, these are Conservative forces, so they conserve energy. That's why we have the definition:

$$E_{mech} = KE + PE$$

If no energy is lost, then the mechanical energy doesn't change because the mechanical energy is the useable energy of the system.

If there is a non-conservative force (pretty much only going to be friction or pushing force), energy is not conserved, so our mechanical energy should change. How much does it change? By the amount the work is done by the non-conservative force!

$$W = \int F_{\parallel} dx$$
$$W_{gain} - W_{lost} = \Delta E_{mech}$$

This equaiton is general, but since you have equations for the work done by springs and gravity, you should only need to use this for grab-bag forces

Other useful equations:

$$W_{conservative} = -\Delta PE$$
$$W = \Delta KE$$

DRAW LOSTS OF PICTURES

as you saw on the view sheet, problem C, the block moves down the ramp when the spring is compressing, so the block loses gravitational potential energy as the spring is compressing as well!! While I doubt there won't be this sort of question on the test (time constraint, but don't trust me, I haven't seen the test!), a trick question making sure you've seen where all the energy has gone is probable.