College of New Caledonia
CNC

Student Readiness Assessment
Mechanical Reasoning

The Mechanical Reasoning portion of the SRA measures your ability to understand basic mechanical principles of machinery, tools, and motion.

There are commercially available study guides for this portion of the SRA which include:

Barron's, *Mechanical Aptitude and Spatial Relations, 3rd edition,* Chapters 1 and 2, Chapter 3, pp. 37–42; Chapters 4 and 5; Chapter 21; Chapter 23, pp. 315–333.

There are also numerous online resources available. A google search for any of the following topics will direct you to study material that is applicable to this portion of the SRA test. Use the discussion below as a starting point to search online for more detailed explanations and practice questions in each of the subject areas.

The Mechanical Reasoning test primarily covers an understanding of the basic mechanical principles behind what are commonly known as the "Six Simple Machines." These include:

1. Wheel & Axle
2. Lever
3. Inclined Plane
4. Pulley
5. Screw
6. Wedge

Wheel & Axle

The test will cover principles of circular motion, such as, how with a pair of horses side-by-side on a carousel (merry-go-round), the speed the horse on the outside is faster than the speed of the horse on the inside. Or another example is a runner on the outside of a curved track has to run faster to keep up with the runners on the inside of the track. The test will also examine your understanding of the rotational motion of gears and belt driven wheels. One gear being driven by another, will have rotate in opposite directions, in other words, a clockwise rotating gear will drive another gear in the counter-clockwise direction. Belt driven wheels, on the other hand, will have the same direction of rotation; a belt drive will rotate all the wheels in the drive in the same direction, unless the belt is twisted into a "figure eight." There are many online resources available with many examples and practice questions of these principles.

Lever

A large portion of the test will examine the principles behind a lever and fulcrum (pivot point). An example is how a see-saw balances on its pivot point. Two children of equal

size will balance on the see-saw if they are the same distance from the pivot point. However, if one child is larger than the other, the larger child must be *smaller distance* from the pivot point than the smaller child is to the pivot point in order for the see-saw to balance. The principle is that it is the weight force times the distance (force x distance) from the pivot that must be the same for the see-saw to balance. Or, in other words, a small force at a large distance is equivalent to a large force at a small distance. Most tools and machine use this principle, in one form of another, to achieve what is called “mechanical advantage.”

Inclined Plane

The principle behind and inclined plane (i.e., a ramp) is similar to the principle of a lever, in that it takes less force to elevate a large weight, into the back of a truck for example, by moving it over a large distance (the length of the ramp) than it would be to lift it the short distance straight up onto the truck bed.

Pulley

Pulleys allow a small force to be magnified into a large force, again similar to how both levers and incline planes magnify forces. A pulley can be rigged so that pulling the pulley rope a long distance with small force will exert a large force over a short distance on an object, such as a vehicle stuck in a ditch. Again, this is the principle that most tools and “simple machines” employ: a small force over a large distance is equivalent to a large force over a small distance.

Screw

A screw works by the same principle as the inclined plane, since the “threads” of a screw act like an inclined plane around the shaft of the screw. Exerting a small force over several turns of the screw (a large distance) will exert a very large force over the small distance the screw advances along its shaft.

Wedge

Like the screw, a wedge is really just another application of the inclined plane principle. Driving a wedge with a relatively small force from a hammer, for instance, over a relatively large distance, will exert a tremendous amount of force over a small distance, such as when splitting a log open.

Understanding the principles behind the simple machines listed above, especially the equivalence of (force x distance) and the rotational motion of gears and belt-driven wheels will cover most of what will be examined on the Mechanical Reasoning portion of the SRA test. Good luck!