Exercise Like An Astronaut!

Astronauts in space exercise between two and two-and-a-half hours a day, six days a week, in order to keep their muscles from atrophying (wasting away) and bones from losing mineral density. On Earth, we work against gravity all day, every day, as we stand and move around. Astronauts don't have to contend with gravity in space, so they need to work out to minimize damage to their bodies.

Without gravity, many typical exercises simply don't work in space. Instead, astronauts rely on specially designed gym equipment, such as a treadmill (the T2), stationary bike (the Cycle Ergometer with Vibration Isolation System, or CEVIS), and the ARED, the Advanced Resistive Exercise Device. These machines are adapted to zero-gravity use, with harnesses and bungees to keep astronauts from floating away while they exercise, or use vacuum cylinders to create resistance on a bar, simulating free weights on Earth. Sounds like a cool place to work out!

The Workout

1. **Let's warm up on the treadmill** – Time to get the heart pumping as we warm up our muscles. **Jog in place** for 15 to 30 seconds. Keep your back straight and shoulders relaxed. Focus your eyes forward. Swing your opposite arm and leg, just like you would with standard running. Try to land on the ball of your foot rather than your heel. Take light steps.
   Seated adaptation: Try some **jumping jack arms**. While sitting comfortably in a sturdy chair, flap your arms, starting with your arms extended downward and hands to your sides. Quickly move your arms over your head. Then, move them down to the starting position again. Repeat for 15 to 30 seconds.

2. **Keep the heart healthy with the CEVIS** – Many astronauts say this is the toughest part of the workout: the stationary bike. It provides important cardiovascular exercise to improve circulation and keep the heart fit. Do six **standing bicycle crunches**. Stand with your feet hip-width apart, with a straight back and knees slightly bent. Place your hands behind your head and brace your abs slightly. Lift your left knee as you rotate your right shoulder toward the knee (try to touch). Lower back to start and repeat on the other side.
   Seated adaptation: Try the reach across. Sitting comfortably, start with your left arm bent in an L by your side. Then, reach across your body and upward, extending your arm above your shoulder. Return to the starting position and repeat on the other side. Complete six repetitions. If you are able, you can also try this exercise with a twist at your waist to increase the stretch.

3. **Build muscle with ARED** – On the ISS, astronauts use the ARED for weight training, increasing the resistance on the machine and the number of repetitions over time to counteract the effects of living in a zero-gravity environment. We don't have weights, but we do have something they don't—gravity! We'll use our own body weight to do a mixture of lower and upper body exercises to keep vital muscle groups strong.

   - **Start with five heel lifts.** Lift up onto your toes with your heels off the floor, and try not to lean forward. It shouldn't hurt! Hold for five to 10 seconds and lower. If you need to, grab

the back of a chair for balance. (*Note: Limited leg mobility? Some exercises you can do with a friend's aid or with the use of a resistance band.)*

- **Keep going with five squats.** Stand with your feet shoulder-width apart and with your toes pointing straight ahead. Keep your spine neutral and your head and chest raised. Engage your abs as you bend your knees and lower your hips down then come back to the starting position. You can lift your arms out in front for extra balance while you lower yourself down. Squeeze your glutes and hamstrings to return to the starting position. Repeat five times! *(Note: You can also try chair squats for a more gentle exercise.)*
- **Do six bicep curls.** Stand with your feet shoulder-width apart. Relax your arms by your side, keeping your elbows close to your body. Contract your right bicep as you raise your right hand toward your shoulder. Keep the movement slow and controlled. Lower your right arm and repeat with the left. *(Note: You can do this exercise while seated.)*
- **Do five shoulder presses.** Stand with feet shoulder-width apart. Raise your hands to shoulder height and bend your elbows at a 90-degree angle. Engage your core and press your hands upward until your arms are extended above your head. Slowly release and repeat. *(Note: You can do this exercise while seated.)*
- **Finish up with five shoulder blade squeezes.** Stand with feet shoulder-width apart. Keep your spine straight and bend your arms at the elbows with your palms facing forward. Move your arms back, slowly squeezing the shoulder blades together, and hold for three seconds. Slowly release the shoulder blades. (*Note: You can do this exercise while seated.)*

4. **Stretch it out** – Whew! If you were an astronaut, you'd have a lot more to do, but I think we're due for a break. Let's take a moment to stretch out our bodies before we relax so we don't get any cramps.

    - Interlock your fingers and stretch with your hands up at shoulder level. Hold for 10 seconds.
    - Raise your clasped hands above your head. Gently lean your body to one side, feeling a deep stretch along the side of your body. Hold briefly. Pause and then return to standing straight. Repeat on the other side.
    - Stand upright and gently bend one knee as if you're going into a sitting position. Place the opposite leg outright, pointing your toes toward the sky. Bend forward at your hips to feel a nice stretch along the back of your outstretched leg. Hold for 10 seconds, then repeat on the other side.

Math Question!

Calculate how long this workout should take you to complete *in minutes*. If an astronaut on the ISS typically exercises for two to two-and-a-half hours a day, how many *more* minutes would you need to exercise to be *equal* to the minimum minutes of exercise an astronaut does?