Year 13 Science: Rotational motion

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A wind turbine turns at 15.0 revolutions per minute. Find its angular velocity and the speed of a blade tip 40.0 m from the hub.

2. A fan spinning at 25.0 rad s^{-1} slows uniformly to rest in 10.0 s. Find its angular acceleration and how many turns it makes.

3. A net torque of 0.900 N m acts on a wheel with rotational inertia 0.0450 kg m^2. Find its angular acceleration.

4. A skater spinning at 3.00 rad s^{-1} changes her rotational inertia from 4.00 kg m^2 to 1.60 kg m^2. Find her new angular velocity and her rotational kinetic energy before and after.

Exam-style question: the potter's wheel

A potter's wheel has a rotational inertia of 0.850 kg m^2. The motor brings it from rest to 12.0 rad s^{-1} in 3.00 s with constant angular acceleration.

5. Calculate the net torque on the wheel while it speeds up.

6. Calculate how many turns the wheel makes in those 3.00 s.

7. With the motor off and the wheel spinning freely at 12.0 rad s^{-1}, the potter drops a 4.00 kg disc of clay, radius 0.120 m, centrally onto it. The clay's rotational inertia is $\frac{1}{2}mr^2$. Calculate the new angular velocity.

8. Explain why the rotational kinetic energy of the system decreases when the clay lands, even though angular momentum is conserved.

Fix the mistake

9. Correct this statement: "1200 rpm is put straight into $\omega f = \omega i + \alpha t$ as $\omega = 1200$."

10. Correct this statement: "Angular momentum is conserved, so rotational kinetic energy is conserved too."

11. Correct this statement: "The torque is F × r, using the distance to where the force acts, even when the force is at an angle."

12. Correct this statement: "The calculator is in degree mode for the trig in a rotation problem."