solutions:

1) Answers will vary here, but my example is a water skiier on a lake. There would be turbulent water surrounding the water skiis depending on how fast the skiier was going.
How could you measure the turbulence?
Could measure speed of water through a pipe or you follow the path of a particle in the water & see how much its path varies from laminar flow. You could also try dying the water to follow the path of the turbulence.

Turbulence could be reduced by slowing down. If the skiier is going slower, the reynold's number will not be as high. You may or may not want to reduce the turbulence. Maybe the skiis ride better with a small amount of turbulence or maybe it is easier to land after a jump with a little turbulence.

If viscosity is reduced, the water will become more turbulent since viscosity is inversely related to turbulence.
What would happen when the skiier went through the air on a jump? Air is less viscous than water, so more turbulence.

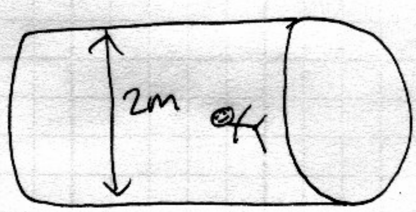
2) - Orb with fluid inside. can see eddies & whirlpools when the orb is turned faster & faster.

- Exhibit with heated metal in water case. Can see the heat flow up through water in a non-laminar fashion. Warm water is less dense than cold water & it rises up then. Again boundary conditions can cause turbulent flow when warm water is moving much faster.

- Exhibit where smoke rings are produced. If you push really hard & fast, no ring appears - only cloud of smoke because too turbulent. Remember turbulence occurs when velocity goes above a certain magnitude.

- other exhibits are possible also → just justify the reasoning.

3)



$\rho = 1000\ kg/m^3$

$\eta_{water} = 2.82 \times 10^{-4}$ Pa·s

$R = \frac{2 v r \rho}{\eta}$

Is this turbulent flow?

Reynold's number must be above 3000 for turbulent flow. If $R < 2000$ laminar flow. If $2000 < R < 3000$ transitional flow

ok I know everything except the velocity of the water through the pipe. I am going to estimate the velocity as 3 miles/hour since rivers moving rather quickly go at around this rate. So now I must change to the right units.

$$\frac{3\,miles}{hr} \times \frac{1\,hr}{60\,min} \times \frac{min}{60\,s} \times \frac{5280\,ft}{mile} \times \frac{m}{3f} = 1.5\,m/s$$

$$R = \frac{2(1.5\,m/s)(1\,m)(1\times10^{3}\,kg/m^3)}{2.82\times10^{-4}\,Pa\cdot s} \times \frac{Pa}{N/m^2} \times \frac{N}{kg\,m/s^2}$$

$$R = 1.04\times10^{7}$$

R is huge, so the water is very turbulent. This makes sense though since there are normally eddies & whirlpools of all sorts at the end of water slides where ~~[illegible]~~ we can see the water & the tube is not even full of water then. A larger radius would mean even more turbulence so this makes sense.