Year 10 Science: Buoyancy: why things float or sink

Name: _____ Date: _____

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

Practice

1. A block weighs 20 N in air and 14 N when completely underwater. What is the buoyant force?

2. A fishing float has a weight of 0.5 N and floats on a lake. What is the buoyant force on it, and why?

3. An object is fully underwater in the sea and displaces 0.003 m³ of seawater (density 1025 kg/m³). Find the buoyant force, using g = 9.8 N/kg.

4. A kayaker paddles from the Waikato River out into the sea at Port Waikato. Does the kayak sit higher or lower in the water at sea? Explain.

5. A student tests whether shape affects floating, using a different amount of plasticine for each shape. What is wrong with this test, and how would you fix it?

Fix the mistake

6. Correct this statement: "Heavy things sink and light things float."

7. Correct this statement: "The buoyant force is always equal to the object's weight."

8. Correct this statement: "The spring balance reading in water is the buoyant force."

9. Correct this statement: "0.46 kg of water is displaced, so the buoyant force is 0.46 N."

Answer key (for parents and tutors)

1. A block weighs 20 N in air and 14 N when completely underwater. What is the buoyant force?
   20 − 14 = 6 N.
2. A fishing float has a weight of 0.5 N and floats on a lake. What is the buoyant force on it, and why?
   0.5 N, because a floating object has balanced forces, so the buoyant force equals its weight.
3. An object is fully underwater in the sea and displaces 0.003 m^3 of seawater (density 1025 kg/m^3). Find the buoyant force, using g = 9.8 N/kg.
   Mass of seawater = 1025 × 0.003 = 3.075 kg; buoyant force = 3.075 × 9.8 ≈ 30 N.
4. A kayaker paddles from the Waikato River out into the sea at Port Waikato. Does the kayak sit higher or lower in the water at sea? Explain.
   Higher: seawater is denser, so the kayak needs to displace a smaller volume to get a buoyant force equal to its weight.
5. A student tests whether shape affects floating, using a different amount of plasticine for each shape. What is wrong with this test, and how would you fix it?
   Mass (and so weight) is not controlled, so any difference could be due to mass instead of shape; use the same mass of plasticine for every shape and change only the shape.
6. Correct this statement: "Heavy things sink and light things float."
   What matters is whether the buoyant force can balance the weight, which depends on density, so a huge steel ship floats while a small pebble sinks.
7. Correct this statement: "The buoyant force is always equal to the object's weight."
   That is only true when it floats; the buoyant force always equals the weight of fluid displaced, which for a sinking object is less than its own weight.
8. Correct this statement: "The spring balance reading in water is the buoyant force."
   The reading in water is what the balance still has to hold up, so the buoyant force is the weight in air minus that reading.
9. Correct this statement: "0.46 kg of water is displaced, so the buoyant force is 0.46 N."
   Mass must be turned into weight, so the force is 0.46 × 9.8 ≈ 4.5 N; kilograms are not newtons.