

8.3 Fluids and Newton's Laws

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS buoyant force 浮力 • archimedes' principle 阿基米德原理 • density 密度
• fluid 流体

Objective

Build the skills to answer exam questions on **fluids and Newton's laws**.

You must be able to:

- treat **buoyancy** 浮力 as a net upward force from a fluid
- state **Archimedes' principle** 阿基米德原理: the buoyant force equals the weight of the displaced fluid
- explain floating and sinking by comparing an object's weight with the buoyant force

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Archimedes' principle

The **buoyant force** equals the weight of the fluid displaced: $F_b = \rho_{fluid} g V_{displaced}$.

■ Float or sink

Compare weight and buoyant force. Float if $F_b \geq \text{weight}$ — equivalently, if the object's density is less than the fluid's.

■ Example

An object of weight 10 N displacing fluid of weight 12 N feels a net upward force $\rightarrow$ it floats up.

2 Practice

2.1 State Archimedes' principle. [2]

2.2 An object weighs 8.0 N in air and displaces fluid weighing 5.0 N when submerged. Find the buoyant force on it. [1]

2.3 State the condition, in terms of density, for an object to float. [1]

3 Exam-style questions

3.1 The buoyant force on a submerged object equals the weight of the [1]

A	B
C	D

- A object
B displaced fluid
C container
D air above it

3.2 An object floats when its density is [1]

A	B
C	D

- A greater than the fluid's
B exactly equal to the fluid's
C less than or equal to the fluid's
D unrelated to the fluid's

3.3 A 2.0 kg block of volume $1.0 \times 10^{-3} \text{ m}^3$ is fully submerged in water ($\rho = 1000 \text{ kg m}^{-3}$, $g = 10 \text{ m s}^{-2}$).

(a) Find the buoyant force on it. [2]

(b) State whether it sinks or rises, with a reason. [2]