

16. Thermodynamics

Starter Quiz · 课前小测

A-Level Physics

Name: _____ Score: _____

1. Internal energy is the sum of which energies?

- ☐ the random kinetic energy of the molecules
- ☐ the potential energy between the molecules
- ☐ the bulk kinetic energy of the whole object
- ☐ the weight of the object

Tick every correct option.

2. The work done by a gas expanding at constant pressure is:

- ☐ $p \Delta V$
- ☐ $\frac{p}{\Delta V}$
- ☐ pV^2
- ☐ $\frac{\Delta V}{p}$

3. Which is the full two-mark definition of internal energy?

- ☐ the sum of the random distribution of the kinetic and potential energies of the molecules
- ☐ the total kinetic energy of the molecules
- ☐ the energy of the object as it moves
- ☐ the heat supplied to the object

4. When a gas expands, it does work on its surroundings.

- ☐ True
- ☐ False

5. A moving train's bulk kinetic energy counts as part of its internal energy.

- ☐ True
- ☐ False

6. A gas expands. In this syllabus's convention, what is the sign of W, the work done ON the gas?

- ☐ negative, because the gas loses energy to its surroundings
- ☐ positive, because work is being done
- ☐ zero
- ☐ it depends on the temperature

7. A tanker of gas driving along a motorway has more internal energy than the same tanker parked, at the same temperature.

- ☐ True
- ☐ False

8. The first law of thermodynamics: $\Delta U = q +$ _____.

9. Internal energy depends only on the state of the system, not on the path taken to reach it.

- ☐ True
- ☐ False

10. A two-mark statement of the first law must define its symbols with direction. Which are correct? Select **all** that apply.

- ☐ Delta U is the increase in internal energy of the system
- ☐ q is the thermal energy transferred TO the system by heating
- ☐ W is the work done ON the system
- ☐ W is the work done BY the system

Tick every correct option.

A-Level Physics

1. **the random kinetic energy of the molecules; the potential energy between the molecules**

Internal energy = random molecular KE + intermolecular PE. The object's overall motion (bulk KE) is separate.

2. **$p\Delta V$**

Force = pA , distance = Δx , so work = $pA\Delta x = p\Delta V$.

3. **the sum of the random distribution of the kinetic and potential energies of the molecules**

Both marks need "kinetic and potential" and the word "random". Without "random" the phrase describes a moving object's energy instead.

4. **True**

Yes — it pushes the piston/atmosphere outward. So the work done *on* the gas is negative.

5. **False**

No — internal energy is the energy of the *random* molecular motion, not the whole object moving along.

6. **negative, because the gas loses energy to its surroundings**

Work done *BY* the gas and work done *ON* it are equal in size and opposite in sign. Confusing the two is the commonest error in this topic.

7. **False**

Bulk motion is not internal energy. The random molecular motion is unchanged, so U is the same; the lorry simply also has kinetic energy.

8. **W**

$\Delta U = q + W$, where W is the work done **on** the gas and q is the heat added.

9. **True**

Yes — U is a function of state (T , p , V , amount); two routes to the same state give the same U .

10. **Delta U is the increase in internal energy of the system; q is the thermal energy transferred TO the system by heating; W is the work done ON the system**

"To the system" and "on the system" are where the marks are. Defining W as the work done by the system flips the sign of the whole equation.