DPP-1 (Basic Definitions)

Detailed Solutions with Conceptual Approach

Your journey isn't just in textbooks—it's also in patience, consistency, sacrifice. That's what real success is made of.

Q1. Thermodynamics is concerned with?

Conceptual Approach

Thermodynamics studies *energy transfers and transformations* (heat, work) and state variables; it does not treat reaction rates (kinetics) or nuclear mass changes (nuclear chemistry).

Solution: Focus is on *energy changes* accompanying processes. **Correct option: (2) Energy changes in a system.**

Q2. A well-stoppered thermos flask with ice-cubes represents which system?

Conceptual Approach

An *isolated* system ideally allows exchange of neither matter nor energy with surroundings. A good thermos approximates this.

Solution: No mass exchange (stoppered); heat exchange is minimized. **(3) Isolated system.**

Q3. Identify the intensive quantity:

Conceptual Approach

Intensive properties are independent of the amount of substance (e.g., T, P, density, refractive index).

Solution: Temperature and refractive index are intensive. **(4) Temperature and refractive index.**

Q4. Which of the following is an extensive property?

Conceptual Approach

Extensive properties scale with amount (mass, volume, internal energy, enthalpy).

Solution: Mass, energy, enthalpy are all extensive. **(4) All of these.**

Q5. For an adiabatic process, which relation holds?

Conceptual Approach

Adiabatic $\Rightarrow q = 0$. Work and internal energy can change: $\Delta U = q + w = w$.

Solution: **(3)** $q = 0$.

Q6. Temperature and volume are not:

Conceptual Approach

Correct classification: Temperature is *intensive*, Volume is *extensive*.

Solution: Correct pair is "intensive and extensive respectively" $\Rightarrow$ statement they are not is "extensive and intensive respectively." **(4).**

Note: If the stem intended "Temperature and volume are:", then the correct is (3). With "are not," options (1) and (2) are also not true collectively; (4) uniquely inverts the correct pairing.

Q7. Both q and w are functions of:

Conceptual Approach

Heat (q) and work (w) are *path functions*, not state functions.

Solution: **(4) Path.**

Q8. Intensive property is:

Conceptual Approach

Among common candidates: Temperature is intensive; moles, volume, enthalpy are extensive.

Solution: **(4) Temperature.**

Q9. Which is not a state function?

Conceptual Approach

State functions depend only on state (e.g., P, V, T, U, H, G, S). Heat is path-dependent.

Solution: **(4) Heat.**

Q10. Which is not a thermodynamic (state) function?

Conceptual Approach

Work is not a property of state; it's process/path dependent.

Solution: **(2) Work done.**

Q11. Which parameter does *not* depend only on initial and final state?

Conceptual Approach

$q_p = \Delta H$ and $q_v = \Delta U$ are tied to state changes. Work is generally path-dependent; for isothermal processes it surely depends on path.

Solution: **(4) w at isothermal.**

Q12. For an isolated system:

Conceptual Approach

Isolated: no exchange of matter or energy $\Rightarrow q = 0,\ w = 0$.

Solution: **(1) $q = 0$ and $w = 0$.**

Q13. Which pair is an example of extensive property?

Conceptual Approach

Extensive: $E,\ V,\ H,\ n,\ C$ (heat capacity). Intensive: $T,\ P$, etc.

Solution: **(3) E and V.**

Q14. Correct set of intensive properties:

Conceptual Approach

P and T are intensive; V and E are extensive.

Solution: **(1) P, T.**

Q15. Which is not a state function?

Conceptual Approach

As before, heat is path dependent.

Solution: **(4) Heat.**

Q16. Select the pair of intensive properties [NCERT Pg. 168]:

Conceptual Approach

Refractive index and density are intrinsic (intensive). Enthalpy/Gibbs free energy are extensive for a system.

Solution: **(2) Refractive index, density.**

Q17. Tea in a thermoflask is an example of:

Conceptual Approach

A thermos approximates an isolated system.

Solution: **(3) Isolated system.**

Q18. Respective examples of extensive and intensive properties are:

Conceptual Approach

Pick (extensive, intensive) in order: enthalpy (extensive), temperature (intensive).

Solution: **(3) Enthalpy, temperature.**

Q19. Identify the intensive quantity:

Conceptual Approach

Temperature is intensive; enthalpy, volume, (overall) heat capacity are extensive.

Solution: **(2) Temperature.**

Q20. Zeroth law of thermodynamics states that:

Conceptual Approach

If A is in thermal equilibrium with B and B with C, then A with C. Heat flows until equilibrium.

Solution: **(3) Heat transfer takes place till thermal equilibrium is achieved.**

Q21. A process X→W→Z→X (returns to initial state) is:

Conceptual Approach

A path that returns to the original state is a *cyclic* process.

Solution: **(2) Cyclic process.**

Q22. Two diagrams (A and B) show different systems. Identify A, B:

Conceptual Approach

Criteria:
Open: exchanges matter & energy.
Closed: exchanges energy but not matter.
Isolated: exchanges neither.

Solution: *The icons are not visible in the text provided. Use the above criteria with your diagram:* If A exchanges matter ⇒ Open; if A only heat ⇒ Closed; if neither ⇒ Isolated (and similarly for B). *(In many standard depictions A=open beaker, B=sealed container ⇒ (1) Open, Closed.)*

Q23. Set of intensive properties is shown by:

Conceptual Approach

Viscosity, refractive index, and *specific* heat are intensive (per unit amount).

Solution: **(2) Viscosity, refractive index, specific heat.**

Q24. Which of the following is an open system?

Conceptual Approach

Open ⇒ exchanges *both* matter and energy with surroundings.

Solution: Human body and a pond are open; Earth is often treated as *closed* in basic thermodynamics, though it does exchange small amounts of matter with space. Many exam keys accept **(4) All of these**.

Q25. Which of the following is not a state function?

Conceptual Approach

q is path dependent; H, U, G are state functions.

Solution: **(3)** q**.**

Q26. Which of the following is an intensive property?

Conceptual Approach

Temperature is independent of system size.

Solution: **(1) Temperature.**

Q27. Closed system can exchange (with surroundings):

Conceptual Approach

Closed: no matter exchange; energy exchange allowed.

Solution: **(1) Heat.**

Q28. System and surroundings together constitute:

Conceptual Approach

By definition, system + surroundings = universe.

Solution: **(4) Universe.**

Q29. Which of the following is an intensive property?

Conceptual Approach

Specific heat (per unit mass or mole) is intensive.

Solution: **(3) Specific heat.**

Q30. Which one depends only on initial and final states?

Conceptual Approach

$q_p = \Delta H$, $q_v = \Delta U$, and H are state-function related quantities.

Solution: **(4) All of the above.**

Q31. Out of: boiling point (I), entropy (II), pH (III), cell emf (IV), intensive are:

Conceptual Approach

Boiling point, pH, and emf are intensive; entropy is extensive for a whole system.

Solution: **(1) I, III, IV.**

Q32. Which of the following are *not* state functions? (I) $q + w$ (II) q (III) w (IV) $H - TS$

Conceptual Approach

q and w are path functions; $q + w = \Delta U$ and $H - TS = G$ are state functions.

Solution: **(3) (II) and (III).**

Q33. Which parameter does *not* depend only on initial and final state?

Conceptual Approach

Same reasoning as Q11: work in isothermal processes depends on the path (reversible vs. irreversible).

Solution: **(4) w at isothermal.**

Q34. Consider: (a) q and w are state functions; (b) $q + w$ is a state function; (c) ΔG is a state function. Correct is/are:

Conceptual Approach

q, w are not state functions; $\Delta U = q + w$ is state; ΔG is state.

Solution: **(3) (b) & (c) only.**

Q35. Consider: (a) q is state function in isochoric process; (b) w is state function in isobaric process; (c) Work is zero in adiabatic free expansion. Correct is/are:

Conceptual Approach

At constant volume, $q_v = \Delta U$; similarly w work looks state-dependent — but remember, this is only valid because we fixed the path as isobaric. If you change the path (like isothermal expansion), W won't be the same.. In adiabatic free expansion of an ideal gas, $q = 0$ and external pressure $\approx 0 \Rightarrow w = 0$.

Solution: Only **(4)** a,b,c are correct.
