

THERMODYNAMICS WS 10

Class 11 - Physics

Section A

1. If the coefficient of performance of a refrigerator is β and heat given out to the surroundings is Q_2 , then the amount of heat absorbed by the refrigerator per cycle is: [1]

a) $\frac{Q_2(\beta + 1)}{\beta}$

b) $\frac{\beta}{Q_2(\beta - 1)}$

c) $\frac{Q_2(\beta - 1)}{\beta}$

d) $\frac{\beta}{Q_2(\beta + 1)}$

2. For which of the following processes is the entropy change zero? [1]

a) Isobaric

b) Isotonic

c) Isothermal

d) Adiabatic

3. **Assertion:** It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another at a higher temperature. [1]

Reason: It is not possible to violate the second law of thermodynamics.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

4. **Assertion:** When a glass of hot milk is placed in a room and allowed to cool, its entropy decreases. [1]

Reason: Allowing hot object to cool does not violate the second law of thermodynamics.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

5. **Assertion:** When a glass of hot milk is placed in a room and allowed to cool, its entropy decreases. [1]

Reason: Allowing hot object to cool does not violate the second law of thermodynamics.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

6. **Assertion:** It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another body at a higher temperature. [1]

Reason: According to Clausius statement “No process is possible whose sole result is the transfer of heat from a cooled object to a hotter object.”

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| a) Assertion and reason both are correct statements and reason is correct explanation for assertion. | b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. |
| c) Assertion is correct statement but reason is wrong statement. | d) Assertion is wrong statement but reason is correct statement. |

7. **Assertion:** The entropy of the solids is the highest. [1]

Reason: Atoms of the solids are arranged in orderly manner.

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| a) Assertion and reason both are correct statements and reason is correct explanation for assertion. | b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. |
| c) Assertion is correct statement but reason is wrong statement. | d) Assertion is wrong statement but reason is correct statement. |

8. **Assertion (A):** First law of thermodynamics is based on energy conservation. [1]

Reason (R): Second law of thermodynamics put limitations on first law.

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| a) Both A and R are true and R is the correct explanation of A. | b) Both A and R are true but R is not the correct explanation of A. |
| c) A is true but R is false. | d) A is false but R is true. |

9. Is it possible that there is change in temperature of a body without giving heat to it or taking heat from it? [1]
10. Is it possible that there is no increase in the temperature of a body despite being heated? [1]
11. Write Clausius statement of second law of thermodynamics. [1]
12. Which thermodynamic law put restrictions on the complete conversion of heat into work? [1]
13. Why does heat flow from a body at higher temperature to a body at lower temperature? [1]
14. Heat cannot flow itself from a body at lower temperature to a body at higher temperature is a statement or consequence of which law of thermodynamics? [1]
15. How does second law of thermodynamics explain expansion of gas? [1]
16. Which law forbids the complete conversion of heat energy into mechanical work? [1]
17. The temperature of the surface of the sun is approximately 6000 K. If we take a big lens and focus the sun rays, can we produce a temperature of 8000 K? [1]
18. Is it possible to convert all the heat extracted from a hot body into work? [1]
19. Why is conversion of heat into work not possible without a sink at lower temperature? [1]
20. Why mechanical energy can be completely converted into heat energy but the whole of the heat energy cannot be converted into mechanical energy? [1]

Section B

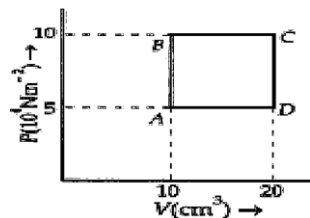
21. **Fill in the blanks:** [2]

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| (a) _____ statement states that no process is possible whose sole result is the transfer of heat from a colder object to a hotter object. | [1] |
| (b) _____ statement states that no process is possible whose sole result is the absorption of heat from a reservoir and the complete conversion of the heat into work. | [1] |

22. State the Second law of thermodynamics and write 2 applications of it? [2]
23. Give two statements for the second law of thermodynamics. [2]
24. State second law of thermodynamics. Write a difference between heat engine and refrigerator. [2]
25. State Kelvin-Planck statement of Second Law of Thermodynamics. What is the significance of this law? [2]

Section C

26. A sample of 2 kg of monoatomic helium (assumed ideal) is taken through the process ABC and another sample of 2 kg of the same gas is taken through the process ADC (Figure). Given molecular mass of Helium = 4. $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$. [5]



- What is the temperature of Helium in each of the states A, B, C and D?
- How much is the heat involved in each of the processes ABC and ADC?