B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

PRE MID-TERM EXAMINATION

PHYSICS (042)

MARKING SCHEME

Class: XI | **Time: 1hr**
Date: 09.01.26 | **Max Marks: 25**

General Instructions:

(i) *There are three sections A, B, and C with 13 questions in total, Section A has 5 Multiple Choice Questions of one mark each, Section B has 4 questions of two marks each and Section C has 4 questions of three marks each.*

Section A

1. (c) Conduction 1
2. (b) decreases 1
3. (d) 40% 1
4. (b) Time rate of heat flow for a given temperature difference 1
5. (d) Assertion is incorrect, reason is correct. 1

Section-B

6.

Isothermal process: From the ideal gas equation $PV = \mu RT$ we have, at constant temperature, $PV = const.$ which is the equation of isothermal change. Now the work done in this process in expanding the gas from volume V_1 to V_2 is

$$W = \int_{V_1}^{V_2} P dV = \int_{V_1}^{V_2} \frac{\mu RT}{V} dV$$

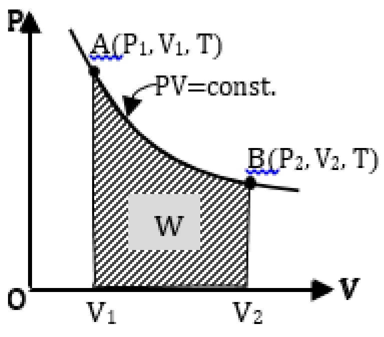
$$= \mu RT \int_{V_1}^{V_2} \frac{dV}{V} = \mu RT \left|\ln V\right|_{V_1}^{V_2}$$

Or, $\boldsymbol{W = \mu RT \ln \frac{V_2}{V_1}}$

Also, from $P_1V_1 = P_2V_2$, we have $V_2/V_1 = P_1/P_2$. With this

$$\boldsymbol{W = \mu RT \ln \frac{P_1}{P_2}}$$

Also, $\boldsymbol{W = Area\ of\ the\ shaded\ region}$



7. Lower fixed point on the wrong scale, **=-10℃**
Let **'n' =** number of the division between upper and lower fixed points on this scale. And Q= reading on his scale,
Then C-O100=Q-(-10)n
Now, C= Incorrect Reading =60℃
Correct Reading =50℃
So, (50-0)/100=60-(-10)/n
50/100=70n
n=70 X 100/ 50
n=140
On, the Celsius scale, the boiling point of water is 100℃.
So, 100-0/100=Q+10/140
Q=140-10
Q=130℃ 2

8. **Isothermal process:**
Temperature: Remains constant ($\Delta T = 0$).
Heat Transfer (Q): Heat is exchanged with the surroundings to keep temperature stable.
Speed: Occurs slowly, allowing time for heat transfer.
Internal Energy (ΔU): No change in internal energy (as temperature is constant).
Examples: Melting ice, slow expansion/compression of gas in a thermally connected container. 1
Adiabatic Process:
Temperature: Changes (increases or decreases).
Heat Transfer (Q): No heat is exchanged with the surroundings (Q = 0).
Speed: Occurs rapidly, preventing heat exchange.
Internal Energy (ΔU): Changes due to work done on or by the system.
Examples: Rapid compression of air in a tire, operation of a refrigerator, insulated containers. 1

9. It states that the heat supplied to a system is partly used to increase its internal energy and the rest to do external work.
$\Delta Q=\Delta U+W$ 2

Section-C

10. **Conduction:** Heat transfer through molecular collisions without actual movement of particles.
Example: Heating one end of a metal rod. 1
Convection: Heat transfer due to actual movement of fluid particles.
Example: Sea breeze—cool air from sea replaces warm air on land. 1
Radiation: Heat transfer through electromagnetic waves without any medium.
Example: Heat from the Sun reaching the Earth. 1

11. Consider a rod of cross-section A with temperature difference ΔT across length L.
Experimentally, heat current (H) is proportional to:
(i) cross-sectional area A 1
(ii) temperature gradient $\Delta T/L$ 1
So, $H \propto A\Delta T/L$
Introducing proportionality constant *K* (thermal conductivity): $H=KA\Delta T/L$ 1

12.

$$C_P = \left(\frac{dQ}{dT}\right)_P$$

or, $dQ = C_P dT$

From equation

$dQ = C_P dT = dU + PdV$

Again, from equation (2)su

$dU = C_V dT$

$C_P dT = C_V dT + PdV$ ...

For one mole of gas (μ =
equation,

$PV = RT$

$PdV = RdT$

From equations

$(C_P - C_V) dT = RdT$

or $C_P - C_V = R$ 3

13.

(a) Efficiency

$\eta = 1 - T2/T1$

$\eta = 1 - 300/500 = 1 - 0.6 = 0.4$ 1

(b) Work done

$W = \eta\, Q_1 = 0.4 \times 600 = 240$ J 1

(c) Heat rejected

$Q_2 = Q_1 - W = 600 - 240 = 360$ J 1

____________________________End of the Paper______________________________________