



Specific heat of a gas is same in both isochoric and isobaric process

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ABSTRACT

The Palchoudhury gas theory and Palchoudhury gas equation have a profound potency applicable to all phenomena of gases. Inner and covered outer surface area of molecules are the outstanding inventions related to gas behaviour. The exertion of infrared wave force on the covered outer surface area of tiny particles and the corresponding effect on the inner surface of a gas container is the real cause of the gas behaviour. We can independently explain all kind of behaviour of gases with the help of the conception the inner force and internal force. We can clarify about the isothermal and adiabatic behaviour of gases, show the relation between heat and force. It is most significant finding, the specific heat of an identical gas in the isochoric and the isobaric process is not different but same as the inner force in both methods is same.

Keywords: Specific Heat, Isothermal, Adiabatic

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INTRODUCTION

Heat, i.e. infrared wave call it as the heat wave. Heat wave holds some force during play up and down in the universe like an ocean wave. Heat wave exerts some force on the outer surface of tiny particles like atoms, molecules, etc. And in turn, the corresponding force consecutively and cumulatively uses an effect on the inner surface of a closed gas container. Every heat wave holds some energy that transfers to the gases and

gases become hot. Again, some external force applies to gas that forces transfers into the heat of gases. It is comprehensive text, and the gases have no specific shape and size. According to Palchoudhury gas theory Palchoudhury (2016), the gas behaviour depends only on four variable (Pressure, temperature, inner surface area and outer surface area). Four variables compatible with Van der Waals constant and fit in all process-like the isochoric, isobaric, isothermal and adiabatic process of gases.

ANALYSIS OF ISOCHORIC AND ISOBARIC PROCESS

On in-depth analysis of the isochoric and isobaric processes of gases shown in the Table 1 and Table 2, reveals the following information,

- a) The inner force of the identical gases is the same in both isochoric and isobaric process on increment 1^{oK} temperature.
- b) The inner force of gases in the isochoric and isobaric process is different for different gases. It is remarkable, the inner force in the isochoric and isobaric process is different for the different size (inner surface area) of same gas as shown for carbon dioxide in Table1 and 2.
- c) For increment 1^{oK} temperature of gases, the internal force of the isochoric process is comparatively higher than isobaric process shown in Table 1 and Table 2. The excess internal force as seen in the isochoric process, the same spends for expanding the inner surface area in the isobaric process and the force remains as a static force (see the Table 2).
- d) Per unit internal force which depends on the covered outer surface of a substance and the inner surface area is a field intensity of gases.
- e) The equal heat wave force requires during the increment of 1^{oK} temperature of gases as found inner force is the same in both for the isochoric and isobaric processes shown in Table 1 and Table 2.

REGARDING HEAT CAPACITY OF GASES

There is an excellent role of size (inner surface area) of a gas in the effect of inner and internal force on increasing 1^{oK} temperature of gases. In Table 1 and Table 2 reveals, the inner force effects heavily on the smallest inner surface area than the larger inner surface area as seen for one-mole carbon dioxide gas. Much more heat wave force requires for the smallest inner surface area than the larger inner surface area to rise 1^{oK} temperature of gases. According to the Palchoudhury gas equation $PS = CnAT$ where P here is pressure, S Inner surface area, C is constant of proportionality, n is number of moles, A covered outer surface area of molecules and T is temperature, Palchoudhury (2016) $PS = F$, that F is the inner force (Palchoudhury, 2017a, 2017b), corresponding to heat depends on the product of pressure and inner surface area. Again, $PS \propto AT$, the inner force corresponding to heat depends on the outcome of the covered outer surface area of tiny particles and temperature.

There is a significant role of the substance per unit inner surface area in the effect of gas behaviour as the internal force depends on the covered outer surface area of the substance. The ratio of internal force which depends on the elements, and the inner surface area have a significant role in the behaviour of gases.

The specific heat of gases is a comparative matter. We may use any gas as a mediator. General text in the standard textbook, $1 \text{ cal} = 4.18 \text{ J}$ and Cv_m (Isochoric)= $H = 4.82 \text{ cal/mole } ^oK$ for Carbon monoxide, and we may treat it as corresponding Cs_m (Isochoric)= $H = 4.82 \text{ cal/mole-K}$ (Heat capacity under constant inner surface area of one mole carbon monoxide). Therefore, $H = 4.82 \text{ /cal}$ for one mole Carbon monoxide. Now,

$$F \propto H \quad \text{or} \quad F = VH \quad (1)$$

so that F is inner force, H is heat and V is nominated as the constant of proportionality. On conceptual based argument, we may accept carbon monoxide (CO) as a mediator. Now, for one mole Carbon monoxide at temperature, 274^{oK} and with inner surface area of 1.65 dm^2 (square decimeter), covered outer surface area of 0.009 dm^2 , and pressure 10.45 MPa (Mega Pascal), when for increasing 1^{oK} (from 273^{oK} to 274^{oK}) in temperature, increase of the inner force $F = 630.77 \text{ N mole K}$ (column-13/100) in Table 1 and when $Cs_m = H = 4.82 \text{ cal/mole-K}$ then, $V=130.73 \text{ N/cal}$ (about). In this paper we have used the following phrases in all Tables, as below;

- 1- The common gases are as, Co_2 , He, Ne, H, Ar, O, N, Co, CH_4 and NH_3 .
- 2- The volume for the gases, He, Ne, H, Ar, O, N, Co, CH_4 and NH_3 is 0.2 and for Co_2 , is 0.05, 0.2 and 22.4 in SI unit.
- 3- We have selected one mole ($n = 1$) for all gases.
- 4- The constant value is $C = 6.681$.
- 5- The inner surface (S) for the common gases, He, Ne, H, Ar, O, N, Co, CH_4 and NH_3 is 1.65 and for Co_2 is 0.66, 1.65 and 38.43.
- 6- The temperature T is 273^{oK} , and the inner force of the identical gases is the same in both isochoric and isobaric process on increment 1^{oK} .
- 7- Here F_{be} and F_{af} are the forces on whole inner surface area before and after increment 1^{oK} , respectively in SI unit (N/m^2).

$$F_{be} = (SP_{be}) \times 10^{-6} \quad (2)$$

and

$$F_{af} = (SP_{af}) \times 10^{-6} \quad (3)$$

where P_{be} and P_{af} are the pressure before and after temperature increment with 1^{oK} and in SI unit respectively.

- 8- The difference between the forces, defined by $\Delta F = F_{be} - F_{af}$ and is in the SI unit (N/m^2).
- 9- The F_{int} is defined as the internal force on the outer surface A covered outer surface area of molecules of gases by heat wave force and following the below,

$$F_{int} = (AP_{af}) \times 10^6 \quad (4)$$

- 10- Here C_p is the specific heat capacity of gases in Kcal and then the Heat of gases is the heat of gases after increment of 1 k temperature of gases bears total heat in kcal. This value will be producing by,

$$H_{gas} = \frac{F_{af}}{130.7398 \times 10^3} \quad (5)$$

- 11- Moreover the heat on outer surface is the heat of outer the surface after increment 1 K temperature, outer surface of molecules bear total heat in Kcal and is

$$H_{out} = \frac{AP_{af}}{130.7398 \times 10^3} \quad (6)$$

and mentioned as H_{out} in the table.

Table 1. The relation between force and heat in isochoric process for individual gases and heat capacity of gases.

Common Gases	V	A	S	P_{be}	P_{af}	F_{be}	F_{af}	ΔF	F_{int}	Cp	H_{gas}	H_{out}
CO2	0.05	0.059	0.66	164.09	164.69	107700436.37	108094943.46	394507.09	9725392.50	3.02	826.79	74.370
	0.2	0.005	1.65	5.33	5.35	8813175.41	8845458.11	32282.69	25844.24	0.25	67.66	0.198
	22.4	0.002	38.43	0.10	0.10	3873704.03	3887893.42	14189.39	214.89	0.11	29.74	0.002
He	0.2	0.012	1.65	12.79	12.84	21151318.25	21228795.60	77477.36	148858.54	0.59	162.37	1.138
Ne	0.2	0.011	1.65	11.88	11.92	19642006.82	19713955.57	71948.74	128372.09	0.55	150.79	0.982
H	0.2	0.011	1.65	12.47	12.52	20627734.13	20703293.60	75559.47	141580.01	0.58	158.35	1.083
Ar	0.2	0.009	1.65	10.12	10.16	16736743.54	16798050.30	61306.75	93205.34	0.47	128.48	0.713
O	0.2	0.010	1.65	10.57	10.61	17480533.09	17544564.35	64031.26	101673.61	0.49	134.19	0.778
N	0.2	0.010	1.65	10.59	10.63	17513337.08	17577488.50	64151.42	102055.57	0.49	134.45	0.780
CO	0.2	0.009	1.65	10.41	10.45	17220252.77	17283330.62	63077.85	98668.36	0.48	132.20	0.755
CH4	0.2	0.008	1.65	8.73	8.76	14439592.78	14492485.06	52892.28	69375.92	0.40	110.85	0.531
NH3	0.2	0.003	1.65	3.37	3.38	5571507.79	5591916.25	20408.45	10328.67	0.16	42.77	0.079

Data (column 1 to 14) collected from (Palchoudhury, 2017a), 1 MPa=10⁶ N/m², 1 kcal = 1000 cal, N= Newton (Force)

Table 2. The relation between force and heat in isobaric process for individual gases and heat capacity of gases.

Common Gases	V	A	S_{be}	P	S_{af}	F_{be}	F_{af}	ΔF	F_{int}	Cp	H_{gas}	H_{out}	ΔS	F_{int} (spent)
CO₂	0.05	0.059	0.656	164.09	0.659	107700436.37	108094943.46	394507.09	9689898.37	3.017	826.79	74.099	0.002	35494.13
	0.2	0.005	1.654	5.33	1.660	8813175.41	8845458.11	32282.69	25749.91	0.247	67.66	0.197	0.006	94.32
	22.4	0.002	38.428	0.10	38.569	3873704.03	3887893.42	14189.39	214.10	0.109	29.74	0.002	0.141	0.78
He	0.2	0.012	1.654	12.79	1.660	21151318.25	21228795.60	77477.36	148315.26	0.593	162.37	1.134	0.006	543.28
Ne	0.2	0.011	1.654	11.88	1.660	19642006.82	19713955.57	71948.74	127903.58	0.550	150.79	0.978	0.006	468.51
H	0.2	0.011	1.654	12.47	1.660	20627734.13	20703293.60	75559.47	141063.29	0.578	158.35	1.079	0.006	516.72
Ar	0.2	0.009	1.654	10.12	1.660	16736743.54	16798050.30	61306.75	92865.18	0.469	128.48	0.710	0.006	340.17
O	0.2	0.010	1.654	10.57	1.660	17480533.09	17544564.35	64031.26	101302.54	0.490	134.19	0.775	0.006	371.07
N	0.2	0.010	1.654	10.59	1.660	17513337.08	17577488.50	64151.42	101683.10	0.491	134.45	0.778	0.006	372.47
CO	0.2	0.009	1.654	10.41	1.660	17220252.77	17283330.62	63077.85	98308.26	0.482	132.20	0.752	0.006	360.10
CH4	0.2	0.008	1.654	8.73	1.660	14439592.78	14492485.06	52892.28	69122.73	0.405	110.85	0.529	0.006	253.20
NH3	0.2	0.003	1.654	3.37	1.660	5571507.79	5591916.25	20408.45	10290.97	0.156	42.77	0.079	0.006	37.70

S_{be} and S_{af} are the inner surface area before and after temperature increment with 1^oK. $F_{int}(spent) = F_{int}$ of Table 1 minus F_{int} of Table 2.

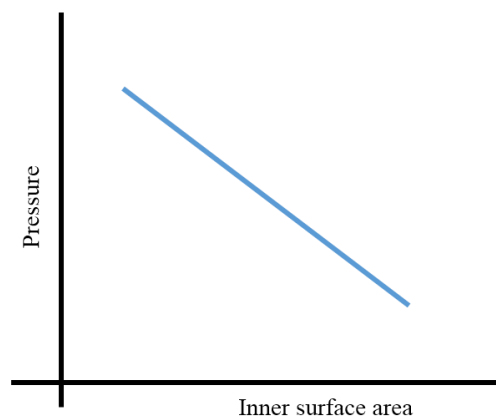


Fig 1. Isothermal Process. (Unchanged temperature Outer surface area)

Table 3. Behaviour of gases under compression and expansion in isothermal process.

Common Gases	V	A_{be}	S_{be}	P_{be}	A_{af}	S_{af}	P_{af}	F_{be}	F_{af}	Gases gains after isothermal expansion	
										F_{gain}	H_{gain}
CO ₂	0.05	0.059	0.656	164.09	0.060	0.69	159.40	107700436.37	109854445.1	2154009	16.47554
	0.2	0.005	1.654	5.33	0.005	1.74	5.18	8813175.41	8989438.92	176263.5	1.348201
	22.4	0.002	38.428	0.10	0.002	40.35	0.10	3873704.03	3951178.11	77474.08	0.592582
He	0.2	0.012	1.654	12.79	0.012	1.74	12.42	21151318.25	21574344.61	423026.4	3.235636
Ne	0.2	0.011	1.654	11.88	0.011	1.74	11.54	19642006.82	20034846.96	392840.1	3.004748
H	0.2	0.011	1.654	12.47	0.012	1.74	12.12	20627734.13	21040288.81	412554.7	3.15554
Ar	0.2	0.009	1.654	10.12	0.009	1.74	9.83	16736743.54	17071478.41	334734.9	2.560313
O	0.2	0.010	1.654	10.57	0.010	1.74	10.27	17480533.09	17830143.75	349610.7	2.674095
N	0.2	0.010	1.654	10.59	0.010	1.74	10.29	17513337.08	17863603.82	350266.7	2.679113
CO	0.2	0.009	1.654	10.41	0.010	1.74	10.11	17220252.77	17564657.82	344405.1	2.634279
CH ₄	0.2	0.008	1.654	8.73	0.008	1.74	8.48	14439592.78	14728384.64	288791.9	2.208905
NH ₃	0.2	0.003	1.654	3.37	0.003	1.74	3.27	5571507.79	5682937.95	111430.2	0.852305

Here F_{gain} is the difference between F_{af} and F_{be} and H_{gain} is the convert into heat of F_{gain}

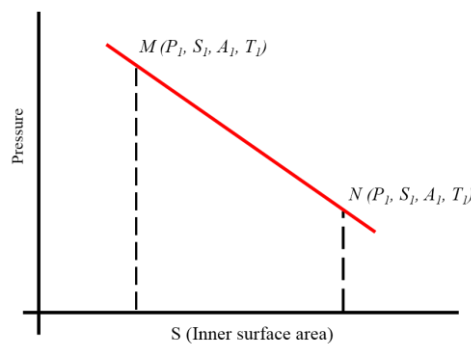


Fig 2. Adiabatic Process

Table 4. Behaviour of gases under compression and expansion in adiabatic process

Common Gases	V	A_{be}	S_{be}	P_{be}	A_{af}	S_{af}	P_{af}	F_{be}	F_{af}	Gases discharges after adiabatic expansion	
										F_{disc}	H_{disc}
CO ₂	0.05	0.059	0.656	164.09	0.056	0.69	142.69	107700436.37	98335181.00	9365255.36	71.63
	0.2	0.005	1.654	5.33	0.005	1.74	4.63	8813175.41	8046812.33	766363.08	5.86
	22.4	0.002	38.428	0.10	0.002	40.35	0.09	3873704.03	3536860.20	336843.83	2.58
He	0.2	0.012	1.654	12.79	0.011	1.74	11.12	21151318.25	19312073.18	1839245.06	14.07
Ne	0.2	0.011	1.654	11.88	0.010	1.74	10.33	19642006.82	17934006.23	1708000.59	13.06
H	0.2	0.011	1.654	12.47	0.011	1.74	10.85	20627734.13	18834018.12	1793716.01	13.72
Ar	0.2	0.009	1.654	10.12	0.009	1.74	8.80	16736743.54	15281374.54	1455369.00	11.13
O	0.2	0.010	1.654	10.57	0.009	1.74	9.19	17480533.09	15960486.74	1520046.35	11.63
N	0.2	0.010	1.654	10.59	0.009	1.74	9.21	17513337.08	15990438.21	1522898.87	11.65
CO	0.2	0.009	1.654	10.41	0.009	1.74	9.05	17220252.77	15722839.49	1497413.28	11.45
CH ₄	0.2	0.008	1.654	8.73	0.008	1.74	7.59	14439592.78	13183976.02	1255616.76	9.60
NH ₃	0.2	0.003	1.654	3.37	0.003	1.74	2.93	5571507.79	5087028.86	484478.94	3.71

$T_{be} = 273^{\circ}K$, $T_{af} = 261.13^{\circ}K$, [here subscripts (be) and (af) indicates the before and after the expansion of the gas respectively]

Data (column 1 to 4) collected from (Palchoudhury, 2017a).

$F_{disc} = F_{be} - F_{af}$, H_{disc} is the convert into heat of F_{disc} .

CONCLUSION

The result of this work show that there is no difference in specific heat of a gas in the isochoric and isobaric process. It is necessary to mention that the inner force in both processes is same due to effect of heat wave force.

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