

PHYS1013

Energy and Matter

$U_i (n_i, P_i, V_i, \dots)$ $U_f (n_f, P_f, V_f, \dots)$

$W = -nRT \int_{V_i}^{V_f} \frac{dV}{V} = -nRT \ln\left(\frac{V_f}{V_i}\right)$ $H = U + pV$ $T(K) = T(^{\circ}C) + 273.15$

$dH = dU + d(pV)$ $dH = dU + pdV + Vdp$

$C_p = (\Delta H / \Delta T)_p$ $\Delta U = Q - W$ $\Delta S = nRT \ln\left(\frac{V_f}{V_i}\right)$

$dU = dq + dw$ $C_p = \left(\frac{\partial H}{\partial T}\right)_p$ $W = P\Delta U$ $W = \int_{V_1}^{V_2} P dV$

$dH = dq - pdV + Vdp$ $dH = C_p dT$ $\Delta H = q_p = C_p \Delta T$ $C_v = (\Delta U / \Delta T)_v$

$H = U + PV$ $\Delta S = \frac{\Delta_{\text{tr}} H}{T}$ $ds \geq \frac{dq}{T}$

$dw = -pdv$ $ds = \frac{dq_{\text{rev}}}{T}$

$C_v = \left(\frac{\partial U}{\partial T}\right)_v$ $\Delta S = \int_1^f \frac{dq_{\text{rev}}}{T}$

$\Delta U = m(u_2 - u_1) \Delta KE$
 $= \frac{1}{2} m (v_2^2 - v_1^2) \Delta PE$
 $= mg(z_2 - z_1)$

$W_b = \frac{P_2 V_2 - P_1 V_1}{1 - \gamma}$ $\eta_{\text{th}} = \frac{W_{\text{net}}}{Q_{\text{in}}} = 1 - \frac{Q_{\text{out}}}{Q_{\text{in}}}$

$dH = dq + Vdp$ $\Delta H = \Delta U + V\Delta p$ $Q = \Delta U + P\Delta V$

$T_R = \frac{T}{T_c}$ $dU = C_v dT$ $\Delta U = q_v = C_v \Delta T$

$\Delta U = q_v = C_v \Delta T$ $\Delta U = U_f - U_i = q(\text{heat}) + w(\text{work})$

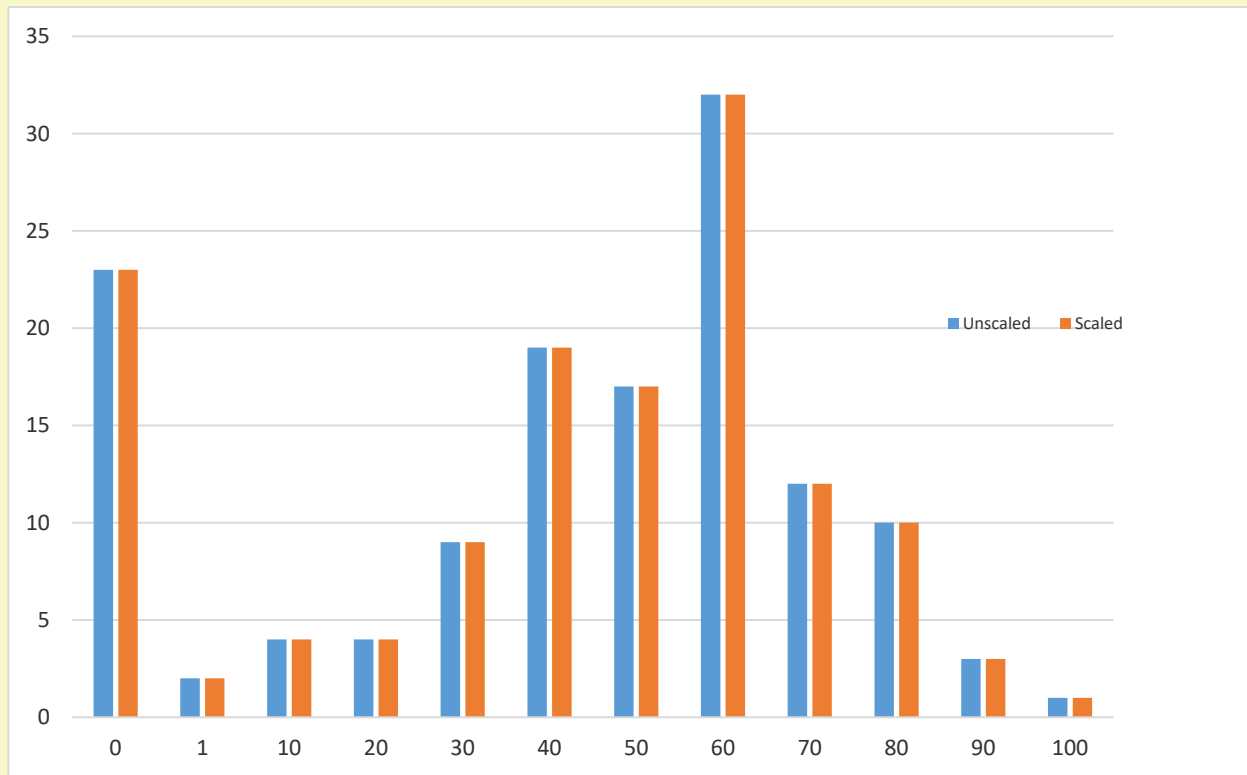
$P_R = \frac{P}{P_{cR}}$ $W_b = P_1 V_1 \ln \frac{V_2}{V_1} = P_1 V_1 \ln \frac{P_1}{P_2} = RT_1 \ln \frac{P_1}{P_2}$

$x = \frac{mg}{m_f + mg}$ $\eta_R = \frac{P_{cR}}{RT_c}$

Thermodynamics

Mid-term Test Mark Distribution

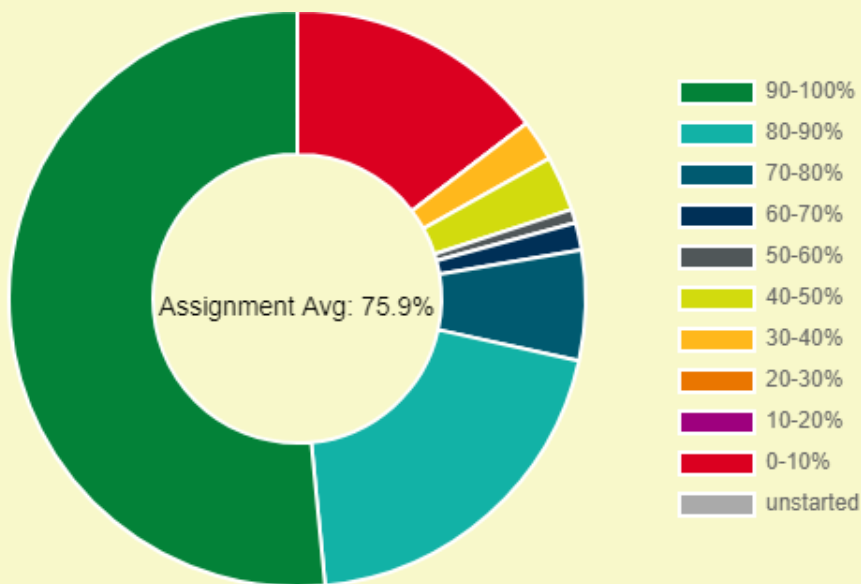
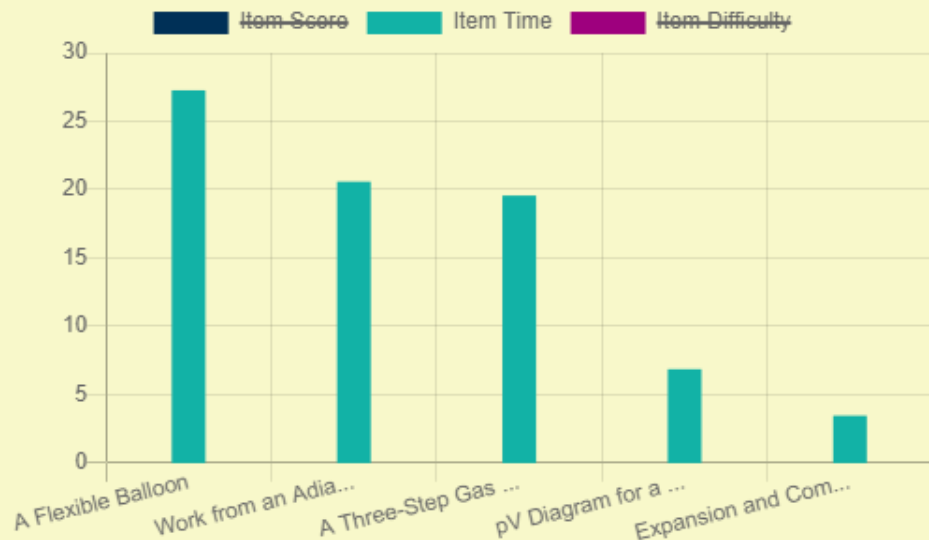
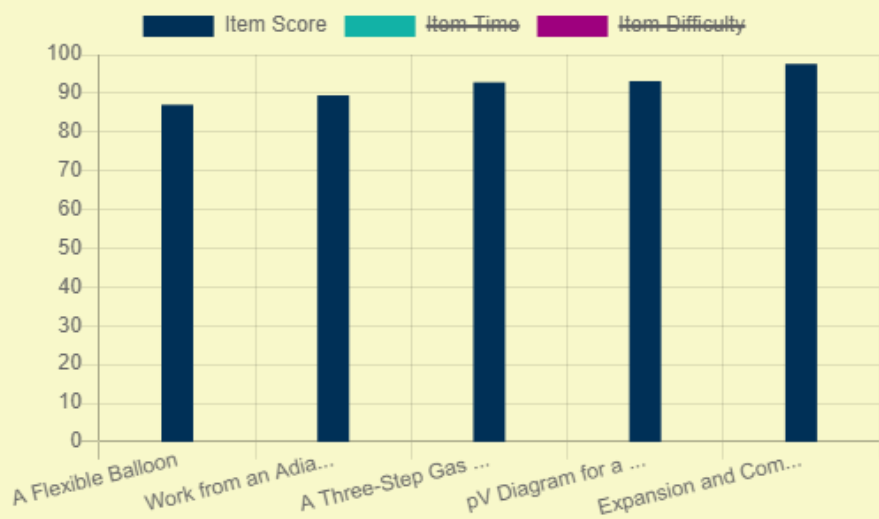
Average 55%



Solutions are on blackboard - you should get papers back from your tutors.

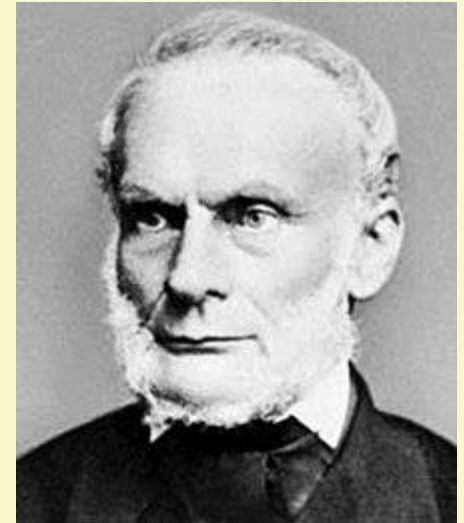
MP Week 6 - average score 76%

Average time 78 min



Rudolf Julius Emanuel Clausius (1822 -1888) was a German physicist and mathematician. Clausius graduated from the University of Berlin in 1844 where he had studied mathematics and physics since 1840.

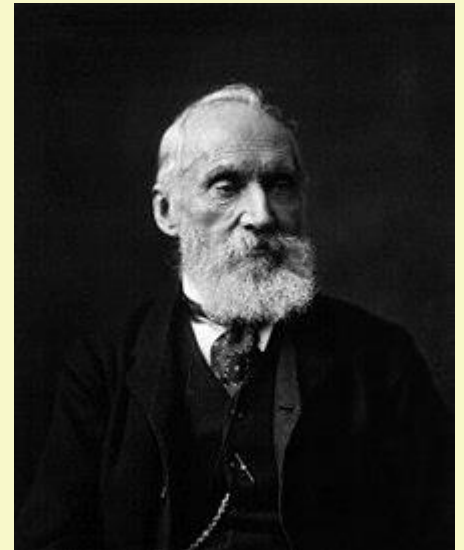
In 1870 Clausius organized an ambulance corps in the Franco-Prussian War. He was wounded in battle, leaving him with a lasting disability. He was awarded the Iron Cross for his services.



William Thomson, 1st Baron Kelvin, (1824 -1907) was a British mathematician, mathematical physicist and engineer born in Belfast. Professor of Natural Philosophy at the University of Glasgow for 53 years.

For his work on the transatlantic telegraph project he was knighted in 1866 by Queen Victoria.

He was ennobled in 1892 in recognition of his achievements in thermodynamics, and of his opposition to Irish Home Rule,[9][10][11] becoming Baron Kelvin, of Largs in the County of Ayr.



Max Karl Ernst Ludwig Planck (1858 -1947) was a German theoretical physicist whose discovery of energy quanta won him the Nobel Prize in Physics in 1918.

The Munich physics professor Philipp von Jolly advised Planck against going into physics, saying, "In this field, almost everything is already discovered, and all that remains is to fill a few holes." Under Jolly's supervision, Planck performed the only experiments of his scientific career, studying the diffusion of hydrogen through heated platinum, but transferred to theoretical physics.

He furthered his work on the field of heat theory and discovered one after another the same thermodynamical formalism as Gibbs without realizing it. Clausius's ideas on entropy occupied a central role in his work.

& on to black body radiation, relativity and quantum mechanics.

