# Chemistry 230 -- Quiz 1

September 5, 2001 — Tellinghuisen

**Pledge and signature:**

**Note:** If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

1. (12) Obtain $dy/dx$ for: (a) $y = e^{\ln(2x)}$; (b) $y = \ln[(3x^2+4)^3]$ (c) $y = 5^{2x^3}$.

(a) $\frac{dy}{dx} = 2$

(b) $dy/dx = \frac{18x}{3x^2+4}$

(c) $dy/dx = 6x^2 \ln 5 \cdot 5^{2x^3}$

2. (8) The ideal gas law reads $PV = nRT$, where $P$ is the pressure, $V$ the volume, $n$ the number of moles, $R$ the gas constant, and $T$ the absolute temperature.

(a) Express $P$ as a function of $V$, $n$, and $T$.

$P = nRT/V$

(b) What are the independent and dependent variables here?

independent: $n, T, V$ ; dependent: $P$

(c) Give a general (formal) definition of $dP$; then evaluate all the partial derivatives to make this expression specific.

$$dP = \left(\frac{\partial P}{\partial n}\right)_{T,V} dn + \left(\frac{\partial P}{\partial T}\right)_{n,V} dT + \left(\frac{\partial P}{\partial V}\right)_{n,T} dV$$

$$= \frac{RT}{V}\, dn + \frac{nR}{V}\, dT - \frac{nRT}{V^2}\, dV$$

3. (6) In problem 11, you had to use the chain rule to obtain the partials $(\partial f/\partial x)_t$ and $(\partial f/\partial t)_x$, when $f$ was defined as $f(x+ct)$. Suppose now that $f = f(u)$, with $u = x^2 + 3t$. Obtain $(\partial f/\partial x)_t$, $(\partial^2 f/\partial x^2)_t$, and $(\partial f/\partial t)_x$. [Express these in terms of $f'(u)$ and $f''(u)$.]

$$\left(\frac{\partial f}{\partial x}\right)_t = 2x\, f'(u) \; ; \; \left(\frac{\partial^2 f}{\partial x^2}\right)_t = 2 f'(u) + 4x^2 f''(u)$$

$$\left(\frac{\partial f}{\partial t}\right)_x = 3 f'(u)$$