# assn1_python

August 30, 2023

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```
import numpy as np
import matplotlib.pyplot as plt
```

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```
### constants ###
c = 299792458
h_si = 6.626e-34  # J s
h_ev = 4.136e-15  # eV s
kB = 1.381e-23  # J / K
```

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```
### Problem 1a ###
wl = 852e-9  # wavelength of cesium in nm
f = c / wl
E_joules = h_si * f  # J
E_ev = h_ev * f  # eV
T = E_joules / kB

print("Problem 1a")
print(f"Energy: {E_joules:.03} J")
print(f"Energy: {E_ev:.03} eV")
print(f"Frequency: {f:.03} Hz")
print(f"Temperature: {T:.03} K")
```

```
Problem 1a
Energy: 2.33e-19 J
Energy: 1.46 eV
Frequency: 3.52e+14 Hz
Temperature: 1.69e+04 K
```

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### Problem 1b ###
wl = 589e-9  # wavelength of sodium in nm
u = 1.66e-27  # kg
m = 22.99 * u

f = c / wl
E = f * h_si
v = np.sqrt(2 * E / m)
print("Problem 1b")
print(f"Velocity: {v:.03} m/s")
```

```
### Problem 1c ###
p = h_si / wl
v = p / m
E = 1/2 * m * v**2
print("\nProblem 1c")
print(f"Momentum of the photon: {p:.03} m kg/s")
print(f"Recoil velocity: {v:.03} m/s")
print(f"Recoil energy: {E:.03} J or {E/h_si*1e12} THz")
```

```
Problem 1b
Velocity: 4.2e+03 m/s

Problem 1c
Momentum of the photon: 1.12e-27 m kg/s
Recoil velocity: 0.0295 m/s or 2.95e+10 pm/s
Recoil energy: 1.66e-29 J or 2.5023254157294932e+16 THz
```

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### Problem 3d ###
S = -(3/4 * np.log(3/4) + 1/4 * np.log(1/4))
print(f"Entropy: {S:.03} kB")
```

```
Entropy: 0.562 kB
```