Problem 1)

In[70]:=
```
M = UnitConvert[sodium ELEMENT [atomic mass], "Kilograms"]; StringForm["M = ``", M]
λ = Quantity[589, "nanometers"];
k = 2 π / λ; StringForm["k = ``", UnitConvert[k, "inverse nm"] // N]
p = ħ k; StringForm["p = ``", UnitConvert[p, "Kg m/s"] // N]
v = p / M; StringForm["v = ``", UnitConvert[v, "cm/s"]]
```

Out[70]= M = $3.81754100 \times 10^{-26}$ kg

Out[72]= k = 0.0106675 /nm

Out[73]= p = 1.12497×10^{-27} kg m/s

Out[74]= v = 2.94684318 cm/s

In[81]:=
```
λ' = 2 π c / (2 π c / λ - k v); StringForm["Doppler shifted frequency λ' = ``. So, Δλ = ``", λ', λ' - λ]
```

Out[81]= Doppler shifted frequency λ' = 589.0000000578964075 nm . So, Δλ = $5.78964075 \times 10^{-8}$ nm

Problem 2)

In[92]:=
```
γ2 = 2 π Quantity[10, "MHz"];
T = ħ γ2 / (4 k); StringForm["T_D = ``", UnitConvert[T, "μK"] // N]
StringForm["T_R = ``", UnitConvert[p^2 / (M k), "μK"]]
```

Out[93]= T_D = 119.981 μK

Out[94]= T_R = 2.40112338 μK