

Answer all questions briefly. DUE in 15 minutes!

1. You have generated a gif file `file.gif` on a metlab machine and you want to move it to rossby so you can display it on the web. Write down the `scp` command to transfer this file to your http directory on rossby

```
scp file.gif username@rossby.metr.ou.edu:http/file.gif
```

2. The thermal advection equation for the adiabatic motion of air parcel to the east is

$$\frac{\partial T}{\partial t} = -u \frac{\partial T}{\partial x}.$$

What is the magnitude of the rate of change of temperature in degrees/second if the zonal wind is 10 m/s and the temperature gradient is 2 K per 100 km?

What is the magnitude in degrees/day?

$$|dT/dt| = |u| |dT/dx| = 10 \times 2 / 100 \times 10^3 \text{ K/s} = 0.0002 \text{ K/s}$$

$$= 0.0002 \times 86,400 \text{ K/day} = 17.3 \text{ K/day}$$

3. Define in words the virtual temperature  $T_v$  of a moist air parcel.

**The virtual temperature of a moist air parcel is a fictitious temperature that is used to take account of the effect of the molecular weight of water vapor on the mean molecular weight of air in the equation of state. Hence, the virtual temperature is the temperature that a dry air parcel must have in order to have the same density as the moist air parcel at the same pressure.**

4. Briefly define what is an adiabatic process and what is a diabatic process.

**An adiabatic process is one in which a system changes its state without any heat being added or removed, and in which there is no change of phase of water in the system ( $dq = 0$ ).**

**A diabatic process involves heat being added or withdrawn from the system by the environment, or a change of phase of water (latent heat release or absorption).**

5. Briefly describe how you would use a thermodynamic diagram to determine the potential temperature of an air parcel with temperature of 10°C at 850 hPa.

**First, find the initial point on the thermodynamic diagram, which is the intercept of the 10°C isotherm and the 850 hPa isobar lines. From this point, follow a dry adiabat ( a line of constant potential temperature) down to the reference pressure level of 1000 hPa. The potential temperature of the air parcel is the temperature of the isotherm that intercepts the dry adiabat at 1000 hPa.**