314 Formula Sheet. This is not exhaustive, and is meant to be a helpful guide. I expect you to also know basic formulae (F = ma, ρ = M/V). In the exam I will give you the value of any nontrivial physical constants you need (e.g., I expect you know $g \sim 10$ ms^{-2}, but not that $\sigma = 5.67\text{e-}8$ W m^{-2} K^{-4})

Math: Taylor series

$$f(x) = f(a) + \left.\frac{df}{dx}\right|_{x=a} (x-a) + \frac{1}{2}\left.\frac{d^2 f}{dx^2}\right|_{x=a} (x-a)^2 + \ldots$$

$$f(x_0 + \Delta x) = f(x_0) + \left.\frac{df}{dx}\right|_{x=x_0} \Delta x + \frac{1}{2}\left.\frac{d^2 f}{dx^2}\right|_{x=x_0} \Delta x^2 + \ldots$$

Rotation:

Vector velocity: $\bar{v} = \bar{\omega} \times \bar{r}$ **;** scalar velocity: $v = r\omega$

Acceleration: $a = \frac{v^2}{r} = \omega^2 r$

Centrifugal force = m rω^2

Space Physics:

F = q**v** x **B** = mv^2/r = mrω

k.e. = ½ mv^2

Energy, radiation, and climate:

Stefan Boltzmann equation: F = σT^4

Wien's law: λ_{max}T= const.

Heat capacity equation: ΔQ = mcΔT

Latent heat equation: ΔQ = mL

One layer Greenhouse model: $Q_0/4(1-\alpha) = \sigma T^4$

Diffusion Equation, Scale analysis $\delta^2 = \kappa\tau$

Ideal gas law: p = ρRT

1st law of thermodynamics: $\Delta Q = c_v \Delta T + p\Delta V$

Hydrostatic balance: dp/dz = -ρg