Here is a list of topics that might come up on the mid-term

Most of the mid-term will focus on materials covered in the labs but you will need to be familiar with material in the lectures. You need to memorize the equations on this sheet that are in boxes.

Know and be able to sketch the basic structure of the Earth (crust, lower/upper mantle, core with approximate thickness of each) and understand the concept of planetary differentiation (Class 1, slides 4-5)

Be able to explain how convection in the Earth is coupled to plate tectonics (Class 1, slides 6-10)

Be able to identify tectonic features on a global scale map of topography/bathymetry with or without earthquakes (Lab 1)

Explain how maps of the seafloor are obtained from satellite altimetry data and from multibeam mapping systems (Lecture 2)

How to identify features on a planetary map and interpret them in terms of the presence or absence of plate tectonics (Lab 2).

Fourier’s Law of Heat Conduction \( q = -k \frac{dT}{dy} \) What the terms are and how to use it to determine the heat flow (Class 3 exercise and Class 4, slide 10)

Be able to identify and interpret plate-boundary features on a tectonic-plate scale map of the seafloor (Lab 3)

Why the thickness of the lithosphere increases as the square root of age (principle explored in Class 3 exercise and Class 4, slides 22-25)

Consequence of plate cooling for the depth of the seafloor (Class 4 and Lab 4) and heat flow (Class 4). How is heat flow measured?

The approximate equation relating cooling time to cooling depth \( h \approx \sqrt{kT} \) or equivalently \( t \approx \frac{h^2}{k} \) What the terms are and how to use the equation to predict a cooling depth (the thickness of the lithosphere) or a cooling time (Class 4, slide 14 and Lab 4)

Definition of crust, mantle, lithosphere and asthenosphere (Class 6, slides 6-7)

Explain with the aid of a temperature versus depth plot why the asthenosphere is weak (Class 6, slide 8)
Basic characteristics of earth’s magnetic field. Orientation and relative strength at poles and equator (Class 3, slide 5)

Know the different kinds of rock magnetization (Class 5, slide 8)

Concept of paleomagnetism, polar wander and the explanation in terms of plate tectonics (Class 5, slides 9-13)

Concept of magnetic stripes/isochrons - how are they created and how are they used to determine spreading rates and date the oceanic crust (Class 53, slides 15-31 and Lab 5).

Be able to convert degrees latitude to kilometers (1 degree of latitude equals 111 km) (Lab 5)

Characteristics of earthquakes (how many and how deep) along different plate boundaries (Class 6 and Lab 1)

Know what an earthquake is, how earthquake sizes are classified, and the different types of body and surface waves (Class 6, slides 6-10)

Understand how seismic waves propagate through the earth (refraction, effects of interfaces) along many different paths and how this constrains the internal structure of the earth (you need to understand the concepts not the naming convention or the details of paths) (Class 6, slides 14-16)

Be able to identify seismic body wave arrivals for a teleseismic earthquake, interpret a seismic travel time curves, and locate an earthquake using S-wave minus P-wave arrival times and P-wave arrival times (Lab 6)

Be able to explain the terms solidus, liquidus, geotherm (Class 7, slide 5-6)

Be able to explain the concept of decompressional melting with the aid of a temperature versus depth plot (Class 7, slide 5). Know how deep melting extends and the maximum percentage of melt beneath mid-ocean ridges (Class 7, slide 8)

Explain the terms solid solution, equilibrium melting, fractional melting, eutectic (Class 7 and Lab 7)

Be able to work with simple 2-component phase diagrams including using the Lever rule qualitatively (Lab 7)

Labeled sketch the basic structure of ocean crust / ophiolite showing the thicknesses of each layer (Class 8, slide 8 and Lab 8 with thicknesses from your interpretation). Know how thick oceanic crust is (6-7 km).

Know the definition of seismic impedance (product of density and velocity) and how it controls the amplitude of seismic reflections (amplitude of reflection relative to incoming wave is change in impedance divided by sum of impedances) (Class 8, slide 24-25)

Know how seismic reflection data is collected (airgun and streamer geometry) and processed (sorting into common mid-points, applying normal moveout, stacking, plotting as a record section) (Class 8, 27-34)
Be able to interpret reflection profiles collected on mid-ocean ridges in terms of oceanic crustal structure (Lab 8)

Labeled sketch of the basic structure of a fast-spreading mid-ocean ridge (Class 9)

Labeled sketch of a slow spreading ridge (Class 9).

Discuss how and why the structure and across-axis bathymetry of slow and fast ridges differ in terms of magmatic, tectonic and hydrothermal processes that form the crust (Class 9)

Be able to describe some basic characteristics of rock types in ocean crust (Lab 9)