1) E) Hot, cold
2) D) all of the above
3) E) latitude
4) B) 12 hours of daylight and 12 hours of night at all latitudes.
5) E) reduce ultraviolet solar radiation
6) B) below
7) C) at places where the angle of incidence is 90°
8) C) location of the prime meridian
9) B) there is more water in the Southern Hemisphere
10) A) decrease of temperature with increasing altitude
11) B) oxygen
12) B) Sun's angle of incidence
13) E) all of the above
14) D) divides the Earth between equal halves of lightness and darkness
15) A) short wave
16) A) higher; the troposphere is warmer in the Tropics and therefore thicker
17) B) increase due to the presence of ozone
18) C) refer to the atmosphere as studied on different time scales
19) A) Mount Everest
20) B) what you expect; what you get
21) E) all of the above
22) B) Mercator
23) E) the highest order of understanding.
24) D) to highlight continents with minimum distortion
25) C) map distance, Earth distance
26) B) Earth description

Question 1.
Lecture notes and online textbooks.

Question 2.
Well, every map is incorrect - that's really not the issue, but: is the map correct enough to be still useful for whatever you need it for. Here are some of the reasons as to why maps are always incorrect:

1. First, there is always geometric distortion when you project a 3D object such as the Earth into 2D. This is amplified by the fact that the Earth is not a perfect sphere.
2. Second, a map is always smaller than the Earth making it necessary to generalize the map by omission of detail, enlargement of important features, and the use of symbols.
3. Third, the Earth always changes, whereas your map is just a static snapshot of the Earth at one particular time.
4. Finally, correct for whom? A distorted Mercator-projection map is actually quite useful for navigation across oceans. A highly-generalized map of the USA is actually quite useful for showing statistics. Both maps are highly-imperfect and incorrect, yet highly-useable for their intended purpose.

Question 3.
If the Earth's axis was not inclined relative the plane of the ecliptic, there would be no June/December solstice – the Earth-Sun relationship would be as on the two equinoxes every day of the year. The day length would be 12 hours at all latitudes, all year around. At any given place on Earth, the noon sun angle would be the same all year around. In other words: There would be no seasons. The key to seasons is that the Earth's rotation axis is a) tilted and b) always points to the North Star, no matter where Earth is in its orbit around the Sun

But, there would be still climate zones as the Earth is still a sphere and therefore the sun angle and associated atmospheric obstruction changes with latitude.

Question 4.
Temperature generally decreases as altitude increases because most of the energy heating the troposphere comes indirectly from Earth's surface and not directly from the Sun. Therefore, as altitude increases, the distance from the source of heat increases as well. In addition, the mean free path between air molecules increases as the altitude increases and this reduces the atmosphere's ability to retain energy.

Temperatures in the troposphere decrease with altitude at a relatively predictable rate. The normal vertical temperature gradient, or average lapse rate, is 6.5°C per 1,000 meters (3.6°F per 1,000 feet). However, the rate at which temperature drops as altitude increases can vary

according to season, time of day, amount of cloud cover, and other factors. This is known as the environmental lapse rate.

⇒ The Hot Sun heats the Earth's surface and the Earth's surface heats the overlying air. Thus, the farther away you go from the heat source the colder it gets.

Question 5.
The atmosphere does two things for us humans.

First, for us living on the surface of the Earth the atmosphere acts like a blanket (or sleeping bag) – keeping the temperature on the Earth's surface within a range that allows for the existence of liquid water = a critical requisite for live. This is achieved via the so-called Greenhouse Effect where the atmosphere traps much of the longwave electromagnetic radiation emitted by the Earth's surface. The atmosphere then takes this energy and emits it back down to us. Without that it would be very cold on the Earth's surface.

However, the top of the atmosphere also emits this energy in the form of electromagnetic radiation back into Space. That, in essence, is a critical cooling mechanism for Planet Earth. Without it Earth would be constantly gaining energy from the Sun and the Earth would be very hot!

Question 6.
This temperature difference is what we are calling the latitudinal heat imbalance of our Earth and is mainly caused by the differences in sun angles and associated amounts of atmospheric obstruction (make sure that you can explain that).

- Tropics = steep sun angle all year, little atmospheric obstruction all year ⇒ hot all-year around.
- Massachusetts = steep sun angle in summer, oblique sun angle in the winter, little atmospheric obstruction in the summer, a lot of atmosheric obstruction in the winter ⇒ colder than the Tropics, warmer than the Arctic with a pronouced seasonal cycle in air temperature.
- Arctic = oblique sun angle all year (or no sun), a lot of atmospheric obstruction all year (or no sun) ⇒ colder than Massachusetts all-year, especially in the winter when the sun is below the horizon.

Question 7.
See http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/prs/hght.rxml and https://www.bbc.co.uk/bitesize/guides/z93dxfr/revision/3