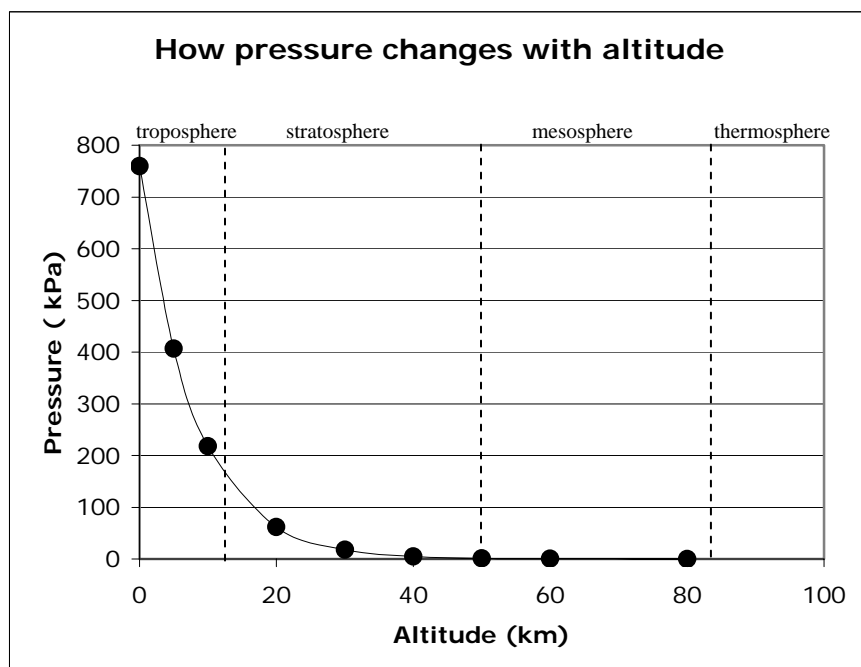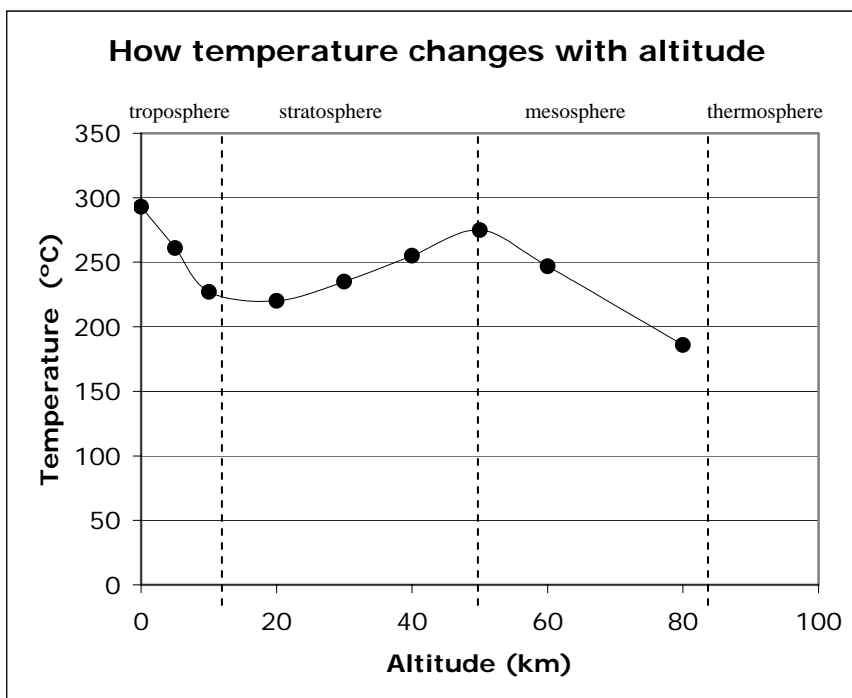# Atmosphere and Pressure Answer Key

1. The troposphere is the first layer of the atmosphere. It stretches 0 to 12 km above the Earth's surface. Its main components are nitrogen (78.08%), oxygen (20.95%), argon (0.93%), and carbon dioxide (0.033%).

2. **(a)** Common units of pressure are atm, mmHg, bar, and kPa.

    (b) $125 \text{ kPa} \times \dfrac{1 \text{ atm}}{101.325 \text{ kPa}} = 1.23 \text{ atm}$

    (c) $743 \text{ mmHg} \times \dfrac{101.325 \text{ kPa}}{760 \text{ mmHg}} = 99.1 \text{ kPa}$

    (d) $550 \text{ mmHg} \times \dfrac{1.01325 \text{ bar}}{760 \text{ mmHg}} = 0.733 \text{ bar}$

    (e) $2.34 \text{ bar} \times \dfrac{101.325 \text{ kPa}}{1.01325 \text{ bar}} = 234 \text{ bar}$

3. **(a)**

How pressure changes with altitude

The shape of the graph is a descending curve (exponential decrease).

(b)

How temperature changes with altitude

The graph first descends, then ascends, then descends once more in a horizontal S shape.

(c) The pressure exhibits a more consistent pattern.

(d) Both pressure and mass of air decrease with altitude.

(e) At 32 000 ft, which is about 9.8 km, the mass of air is approximately 0.41 g, using the data in the table. The pressure is about 218 mmHg, and the temperature is approximately −45 ℃, using the graph to interpolate data.

(f)

Atmospheric layer	Boundaries (in km above Earth's surface)
Troposphere	0 to 12
Stratosphere	12 to 50
Mesosphere	50 to 83
Thermosphere	83 to 700

(g) Change in pressure will cause the balloon to expand, and changes in temperature will cause the balloon to contract. The effect on the balloon is a combination of both changes. This leads to the combined gas laws.

4.

$$P = \frac{F}{A}$$

Substitute mg in for F:

$$P = \frac{mg}{A}$$

Substitute dV in for m:

$$P = \frac{dVg}{A}$$

Substitute lwh in for V and lw in for A:

$$P = \frac{d\not{l}\not{w}hg}{\not{l}\not{w}}$$

$$P = dhg \text{ or } dgh$$

$V = \text{length} \cdot \text{width} \cdot \text{height}$

$V = lwh$

$A = \text{length} \cdot \text{width}$

$A = lw$

5. You could carry a pressure probe attached to a CBL and measure the pressure in Calgary or Vancouver, and then take the probe up with you on a mountain trail. The data can be taken as the mountain is climbed by foot or by car. You could take a bag of chips up a mountain and see if the bag expands due to the expansion of air inside caused by a pressure decrease outside. You could try to boil water on a mountain top. Carry a thermometer and when boiling occurs, take the temperature. Boiling occurs when the vapour pressure of a liquid equals the atmospheric pressure. If the atmospheric pressure is lower, then the boiling point will also be lower.