Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

natural: greenhouse gases that occur naturally keep Earth about 33 °C warmer than it would be, making life possible; enhanced: extra greenhouse gases from human activity trap more heat and raise the mean temperature further

2.2

warming thaws frozen soil (permafrost) in the Arctic; dead organic matter in it decomposes and releases CO_2 and methane; these greenhouse gases cause more warming, so more permafrost thaws, and the change grows

3.1

(a) $414 - 317 = 97$ ppm over 60 years; $97 \div 60 \approx \mathbf{1.6}$ ppm per year

(b) the Northern Hemisphere has most of the land and plants; in its summer photosynthesis takes in CO_2, so it falls; in winter respiration and decay continue but photosynthesis slows, so it rises

3.2

(a) any two: flooding and loss of land from sea-level rise; salt water entering wells and farmland; stronger storms; coral reef damage that harms fishing and coastal protection

(b) physical exposure differs, e.g. low coasts, dry regions and the Arctic change most; poorer countries have less money and technology to adapt, such as sea walls or irrigation; many depend more on farming and fishing, which are sensitive to climate

3.3

award up to [5]: a tipping point is a threshold after which a system shifts to a new state that is hard to reverse; examples: Greenland ice sheet, Amazon dieback, permafrost; positive feedbacks could push warming beyond human control; but the exact thresholds are uncertain, and some may be centuries away; conclusion: uncertainty and high risk support urgent action (precautionary principle)

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