6.1 Climate evidence, energy budgets and policy

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS mitigation • adaptation

Objective

Climate evidence, energy budgets and policy. Original classroom practice for IB HL; not an official IB paper.

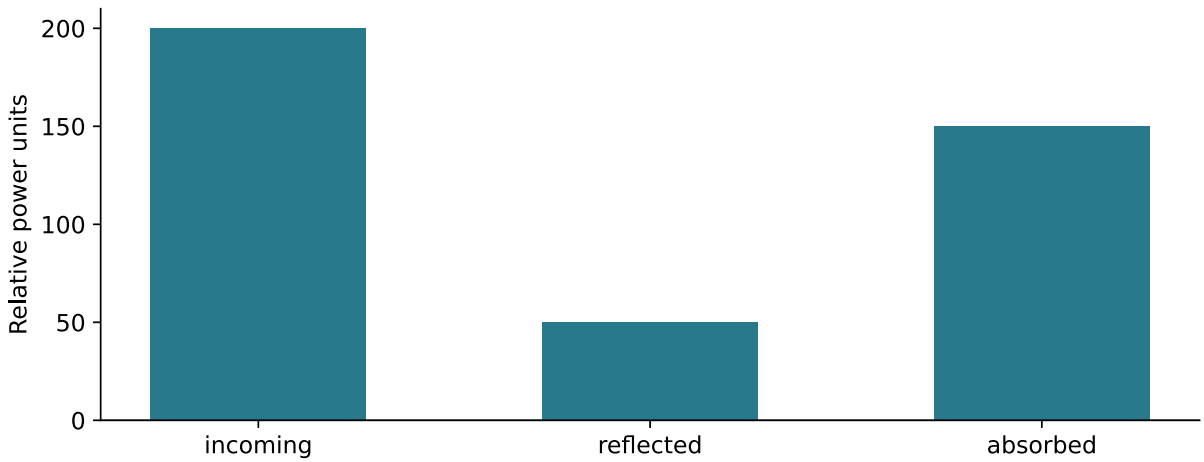
1 Key knowledge and worked examples

What would explain this observation?

- One cold day does not disprove a warming climate. Weather describes short-term conditions; climate describes distributions over longer times and regions.

Build the model

- The Earth energy balance includes incoming solar radiation, reflection, absorption and outgoing infrared radiation.
- Greenhouse gases absorb and emit infrared radiation.
- Feedback can alter the response to an initial forcing.
- **mitigation** : Actions addressing causes of environmental change.
- **adaptation** : Actions reducing harm from environmental impacts.



Choose evidence that can test it

- Distinguish mitigation, which addresses drivers, from adaptation, which reduces harm from impacts.
- A policy assessment needs evidence about effectiveness, cost, equity and uncertainty; one criterion is not the entire decision.

In the lab: Compare multi-year data using consistent baselines. State the region, timescale and uncertainty. At HL, connect a management decision to law, economics and ethics rather than treating these lenses as extra definitions only.

Work from known quantities

- Known: a surface receives 200 power units and reflects 50.
- Absorbed input = incoming-reflected = 200-50 = 150.
- Reflected fraction = 50/200 = 0.25 = 25%.
- A change in reflectivity alters the absorbed budget under this model.

Your turn: Incoming energy is 240 units and reflected energy 72. Find reflected percentage.

Check the conclusion and its limits

- The greenhouse effect is not the same process as ozone depletion.
- A carbon footprint estimate depends on its system boundary.

Not true: One local weather observation establishes a global climate trend. Weather is a short-term local state; climate is the long-term statistical pattern. One cold day in one city cannot confirm or refute a global trend built from decades of worldwide records.

Key:

- The Earth energy balance includes incoming solar radiation, reflection, absorption and outgoing infrared radiation.
- Distinguish mitigation, which addresses drivers, from adaptation, which reduces harm from impacts.
- Watch for: the greenhouse effect is not the same process as ozone depletion.

Write from 20 percent reflected

- A surface receives 500 energy units and reflects 100.
- Find the reflected percentage and the absorbed input. One local weather observation does not establish a climate trend.

2 Practice

2.1 Which action is adaptation to flood risk? Choose one answer.

- **A** Raising vulnerable electrical equipment above expected flood level
- **B** Pretending the risk is zero
- **C** Only measuring global CO2 [1]

2.2 Incoming energy is 240 units and reflected energy 72. Find reflected percentage. Show the relation, substitution and units. [2]

2.3 Decide whether this claim is true and justify: Weather is a short-term local state; climate is the long-term statistical pattern. [2]

2.4 Actions addressing causes of environmental change: write the technical term. [1]

3 Exam-style questions

3.1 Two fictional surfaces each receive 240 W/m^2 and reflect 60 and 96 W/m^2. Compare absorbed inputs. Could this alone predict their equilibrium temperatures? [4]

Solutions

2.1 A Adaptation reduces the impact of a risk that remains - moving equipment above flood level does exactly that. Measuring CO2 is monitoring, and ignoring the risk is neither mitigation nor adaptation.

2.2 reflected percentage=72/240×100=30%.

2.3 True. True. Weather is a short-term local state; climate is the long-term statistical pattern. One cold day in one city cannot confirm or refute a global trend built from decades of worldwide records.

2.4 mitigation. mitigation means Actions addressing causes of environmental change.

3.1 Absorbed inputs180 and144 W/m^2. The first absorbs36 more. Emission, transport and other boundary conditions are also needed for equilibrium temperatures; mitigation/adaptation judgements require additional evidence.