Exercise walk-through

5.1 Climate evidence, energy budgets and policy

International Baccalaureate · IB Diploma · Physics · SL

INTERNATIONAL BACCALAUREATE · IB DIPLOMA · PHYSICS · SL • EXERCISE SHEET

5.1 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 SL; not an official IB paper.

1 Key knowledge and worked examples

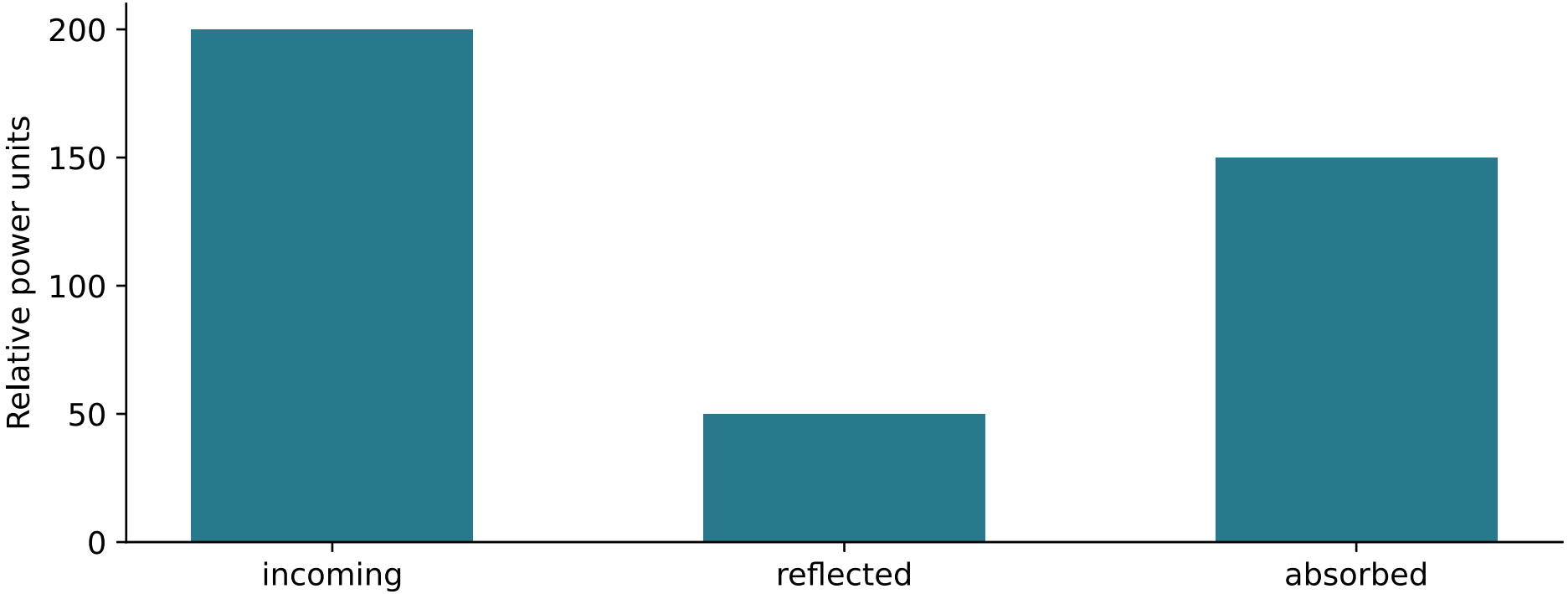
What would explain this observation?

- 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 a reflected share of 16 percent

- Incoming energy is 250 units and reflected energy is 40 units.

- Find the reflected percentage. One local weather observation is not a climate trend.

Exercises 2.1·2.3

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]

Exercises 2.1·2.3

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]

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

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

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]

2.3 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.

Exercises 2.4·3.1

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

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]

Exercises 2.4·3.1

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

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

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]

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.