Exercise walk-through

# 40.1 Climate evidence, energy budgets and policy

International Baccalaureate · IB Diploma · Biology · HL

INTERNATIONAL BACCALAUREATE · IB DIPLOMA · BIOLOGY · HL • EXERCISE SHEET

# 40.1 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

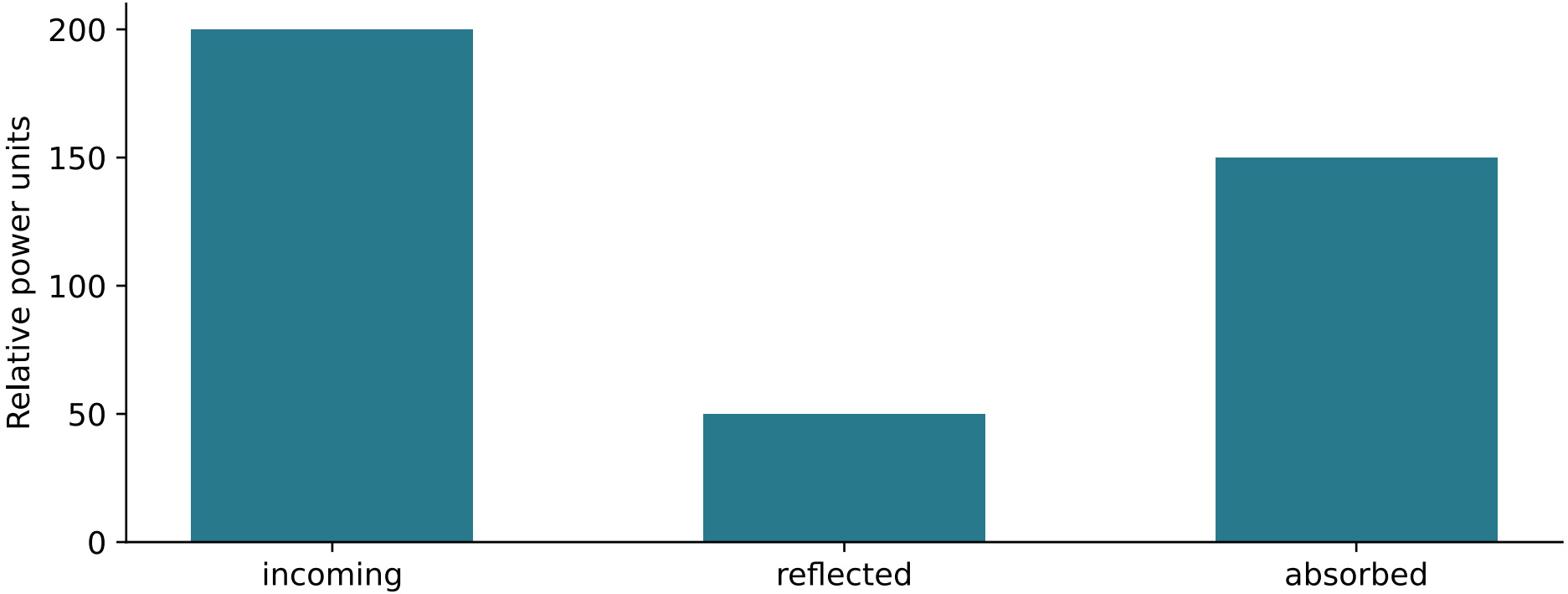
### What would explain this observation?

- 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.

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## 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.

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## ■ 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 20 percent

- A surface receives 180 energy units and reflects 36.

- Find the reflected percentage and the absorbed amount.

# 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.

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**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%.

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**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]

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**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.

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**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.