Breathing, exercise and alveolar exchange

Student activity • practical and reasoning

YEAR 10 / LESSON 56 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

How does breathing change after gentle activity, and what evidence shows carbon dioxide release?

Observe carbon dioxide release and optionally record gentle-activity breathing changes.

Equipment

- Timer and individual recording sheet
- Teacher-operated CO_2 sensor suitable for exhaled-air enrichment and display
- Clear space for optional gentle marching

Participation is voluntary. Follow existing school health plans and offer observer/data roles without requiring public medical disclosure. No vigorous exercise, breath holding or deliberate rapid breathing. Stop if dizzy, breathless beyond comfort, wheezy or unwell and tell the teacher. Never share mouthpieces or breathe into a sealed container.

Course coverage: Shared Biology / Double Award: 2.48 and 2.50. Alveoli and breathing investigation.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Observe the teacher's carbon-dioxide sensor demonstration comparing room air with a gently exhaled breath passing near the sensor. Record actual readings, units and any range limit; no mouth contact or shared mouthpiece.

2. Explain why dilution with room air prevents this open demonstration measuring the exact percentage in exhaled air.

3. For the optional activity, sit quietly for three minutes, then count complete breaths over 60 seconds. Observers may use supplied anonymised data instead of exercising.

4. If cleared by the teacher, march gently on the spot for one minute at the agreed comfortable pace. Stop immediately if uncomfortable; do not compete, hold your breath or hyperventilate.

5. Count breaths in each successive 60-second recovery interval for up to three minutes. Label interval counts accurately rather than calling them instantaneous rates.

6. Graph your own recovery counts and explain them using respiratory demand. Link alveolar surface area, thin barriers, ventilation and blood flow to diffusion.

Cleanup

- Restore seating, wash hands as appropriate and clean the sensor according to its manufacturer.
- Keep only anonymised class summaries if comparing results.

Record your evidence

Blank spaces are for your own work

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Reference and task data

One breath is one complete inhalation/exhalation cycle. Breathing rate and depth can both change, but counting measures rate only. The sensor demonstration shows CO_2 enrichment under its conditions, not a precise exhaled-air composition. Individual recovery results are not fitness or health diagnoses.

Interval	Breaths counted	Duration / s	Notes
Rest		60	
Recovery 0–1 min		60	
Recovery 1–2 min		60	
Recovery 2–3 min		60	

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. What does one counted breath include?

2. Why use a full-minute count?

3. Does rate alone measure total air volume?

4. Why can exercise raise ventilation?

5. Give two alveolar adaptations.

6. Why is an open sensor reading not exact breath composition?