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Skeletal Muscle Ergography

Practical 04 / Teaching laboratory

Aim

Measure external work in a standardised ergography exercise or supplied trace.

Principle

The work of lifting a constant load against gravity equals its weight multiplied by the total vertical displacement. Fatigue can reduce the height reached on successive contractions.

Materials and Requirements

- Supervised ergograph or supplied calibrated trace
- Known load and displacement scale
- Recording sheet

Procedure

1. Check scale, zero and mass. Record starting posture and the planned cadence.
2. Verify the vertical scale and starting baseline without movement. Confirm the assigned resistance and supervised posture for the teaching run before starting.
3. Record or read successive vertical lift distances in metres using consistent landmarks.
4. Begin at the preset cue and take a consistent baseline-to-peak measurement from each accepted lift. Mark an incomplete lift or sensor disturbance on the trace.
5. Record the lift number, displacement and timing in a table. Convert centimetres to metres and confirm that the lab's trace corresponds to actual vertical displacement.
6. Add the displacements against the stated load and calculate gravitational work.
7. Convert mass to force using the stated gravitational acceleration. Multiply by each displacement or the summed displacement for a constant load and report work in joules.
8. Compare early and later lift amplitudes with workload and cadence held constant.
9. Compare the first and last set of lifts made under matching conditions. Describe the amplitude change and record pauses, technique changes or tracing problems that affect the comparison.

Precautions

- Keep testing within instructor-approved effort and stop if painful.
- Distinguish external mechanical work from metabolic energy expenditure.

Observations and Interpretation

Skeletal Muscle Ergography

Observations and Record

Item	What to record	What it tells you
Load	Mass in kg and force in newtons	Force = mass × gravitational acceleration
Displacement	Sum of vertical lifts in metres	Use total measured distance
Work and fatigue	Joules and change in trace amplitude	Describes external work and trace behaviour

Worked Example

A 1.0 kg load lifted through a total vertical distance of 0.30 m gives 1.0 × 9.81 × 0.30 = 2.94 J of external work.

Result and Interpretation

Report cumulative work and interpret the trace pattern within the stated effort and recording conditions.

Viva Questions and Answers

What unit is used for work?

The joule, equivalent to one newton metre.

What can alter the trace besides fatigue?

Effort, cadence, friction or changes in starting posture.

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