Resultant force and acceleration: constant system mass

Teacher / technician

YEAR 10 / LESSON 5 / PHYSICS + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Record actual measurements separately from labelled practice examples.

Coverage and delivery

Shared Physics / Double Award: 1.17, 1.21. Force, acceleration and terminal motion.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, five groups of six

Item	Per pair / setup	Class total
Trolley/track/pulley/string/stop set	1 per group	5 sets
Compatible recording device	1 per group	5
Small masses and holder	1 staff-piloted set per group	5 sets
Padded collection tray	1 per group	5
Balance	Shared	2
Booklet and graph paper	1 of each per learner	30 of each

Immediate safety

Secure the track and pulley. Keep feet and fingers away from falling masses and moving trolleys; catch the holder in a padded tray. Use only staff-approved small loads and short drops. Keep string clear of walkways; stop the trolley safely without reaching into its path.

Preparation and delivery

Read alongside the student method

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1. Prepare five groups of six. Pilot five small hanging masses and the usable run interval; record their actual values for pupils. Do not prescribe a load without checking the apparatus and stop.

2. Check total mass with all transfer masses included, secure masses on the trolley and keep the track level. Ensure the holder lands safely before a collision.

3. Select wheel-derived velocity in the compatible software and demonstrate the fitting interval. Check sign convention and verify that increasing driving force increases measured acceleration.

4. The terminal-speed extension is diagram analysis only; no parachute drop, raised platform or falling heavy load is required.

Close of lesson

• Support the hanger before removing masses; disconnect the string and return masses, trolley and sensors to storage.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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- To keep total system mass constant while changing the driving force.
- 0.50 m s^{-2}.
- Acceleration is the rate of change of velocity.
- The force conditions change when the hanger is supported.
- Only approximately if friction and pulley effects are negligible.
- Zero; drag balances weight for vertical fall with negligible upthrust.

References and provenance

Pearson Physics specification

Vernier Go Direct Sensor Cart manual

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.