

Paper 2 explanations and practical methods

AQA GCSE Combined Science Trilogy 8464 and Separate Physics 8463 | Both tiers | Paper 2

20 parts / 40 marks per route | Estimated/untrialled 35–40 min independent +15–20 review

Specification points covered

8463 4.5.3 / 8464 6.5.3: spring deformation, proportionality and valid force–extension measurements

8463 4.5.6.2.2 / 8464 6.5.4.2.2: resultant force, mass, acceleration and investigation controls

8463 4.6.1.2 / 8464 6.6.1.2: wavelength, frequency and ripple speed measurements

8463 4.6.2.2 / 8464 6.6.2.2: selected infrared surface investigation skills only

A science centre is commissioning a model trolley ride, spring safety buffer and wave demonstration for a public event. Check the team's measurements and explanations before it writes the demonstration guides.

Complete Sections 1–6, then ONE task in Section 7, as directed by your teacher. Do not answer both final alternatives. Show calculations and link explanations to the evidence. Use $F = ke$, $F = ma$, frequency = number of complete oscillations / time, and $v = f\lambda$.

1 Checking the spring buffer

A model buffer contains a compression spring. Its unloaded length is 80.0 mm. With a 3.0 N compressive force its length is 68.0 mm. Table 1 gives further static measurements, taken after the spring settles.

1(a) Calculate the compression of the buffer spring at 3.0 N. **[1 mark]**

1(b) State what is meant by elastic deformation of a spring. **[1 mark]**

1(c) Use the 3.0 N reading to calculate the spring constant in N m^{-1} . **[2 marks]**



1 Checking the spring buffer continued

Table 1

Force / N	Compression / mm
1.0	4.0
2.0	8.0
3.0	12.0
4.0	20.0

1(d) Can the same k be used at 4.0 N? Explain using a numerical comparison from Table 1. **[2 marks]**

2 Improving the spring measurements

The team also investigates a different tension spring using Figure 1. The pointer is fixed to the lower end of the spring and moves with it; the ruler stays fixed. Ruler ticks are schematic, not numerical readings. Each calibrated load label gives the TOTAL force including its holder.

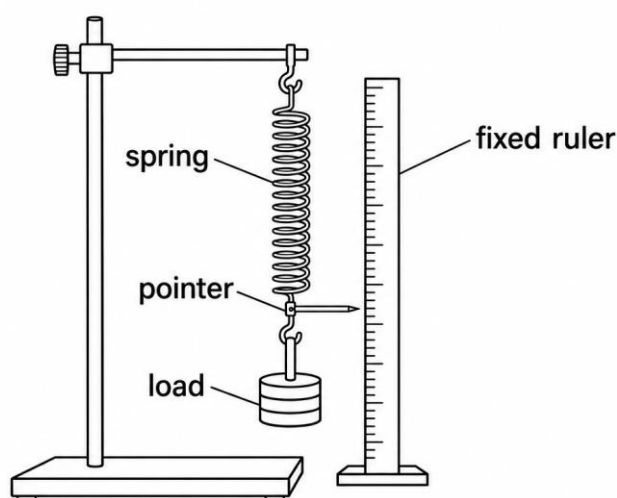


Figure 1

2(a) Describe how the pointer and ruler can be used to obtain the extension for each force. Explain why recording only the loaded reading is insufficient. **[2 marks]**

Continue your physics journey

Videos, practice and support for your next step

www.physicsuk.co.uk



2 Improving the spring measurements continued

2(b) Give two reading precautions for Figure 1. Explain the problem each reduces. **[2 marks]**

2(c) A spring stops following a straight proportional trend as the force increases. Explain how to check whether this has also caused permanent deformation. **[2 marks]**

3 Testing the trolley ride

The team tests a small model trolley on a level track. An accelerometer measures its acceleration independently. The supplied force values are RESULTANT horizontal forces, not uncorrected pulling forces.

3(a) Calculate the resultant horizontal force for a 0.50 kg trolley accelerating at 0.60 m s^{-2} . **[1 mark]**

3(b) Test R uses 0.30 N and gives 0.60 m s^{-2} . Test S uses 0.60 N and gives 1.20 m s^{-2} . Both use the same trolley mass. Explain whether these readings agree with $F = ma$. **[2 marks]**

3(c) To test only the effect of force, a technician increases the force but also adds a heavy display model to the trolley. Explain the fault and how to correct it. **[2 marks]**

3(d) A trainee calculates every acceleration from F / m and plots those values to “verify $F = ma$ ”. Explain why the accelerometer readings provide a stronger test. **[2 marks]**

Continue your physics journey

Videos, practice and support for your next step

www.physicsuk.co.uk



4 Checking the wave demonstration

In a calibrated frozen image of a ripple tank, six consecutive crests extend from the 3.0 cm position to the 18.0 cm position. In the recording, 12 complete oscillations take 3.0 s of real time. Water depth and vibrator setting are steady.

4(a) Use the image and recording data to calculate wave speed in m s^{-1} . Show your working. **[3 marks]**

4(b) Slow playback makes the same 12 oscillations take 18 s to watch. A trainee uses 18 s to calculate the actual wave frequency. Explain the error and give the correct frequency. **[2 marks]**

4(c) Suggest two ways to improve a wavelength measurement from an image. Link each improvement to a measurement problem. **[2 marks]**



5 Choosing a surface for the infrared exhibit

The exhibit compares how two surface finishes affect heating under an infrared lamp. Except where a question states a fault, the cells have equal size, shape and water mass, the same initial temperature, exposed area, orientation and lamp-to-face distance, and the lamp output is steady.

Table 2

Finish	Initial temperature / °C	After 3 minutes / °C
Matt black	20	28
Polished metal	20	24

5(a) In a faulty trial, the matt-black cell is 20 cm from the lamp and the polished cell is 40 cm away. Explain one change needed for a valid comparison of the finishes. **[2 marks]**

5(b) Table 2 comes from a corrected trial. Which finish is supported for a cell intended to warm most in 3 minutes? Use the temperature rises, and state one limit to the conclusion. **[2 marks]**

5(c) A repeat trial uses 80 g of water in the black cell and 160 g in the polished cell. Explain why comparing only their temperature rises is now insufficient. **[2 marks]**





