

# Exam Practice Guide

## Units 3 & 4

Physics: Detailed Study 3.1 - Einstein's special relativity

## Examination Questions

### Key Features:

- ✓ 29 original examination style questions on all examinable topics.
- ✓ Full solutions and a marking guide to all questions.
- ✓ Separated into key topic areas within each Area of Study, enabling students to master one topic at a time.
- ✓ Written by VCE assessors who mark the real examinations.
- ✓ Excellent resource for examination practice.

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***Helping VCE students be the best they can be.***

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TSSM

ACN 099 422 670

ABN 54 099 422 670

**A:** Level 14, 474 Flinders Street Melbourne VIC 3000

**T:** 1300 134 518

**F:** 03 97084354

**W:** [tssm.com.au](http://tssm.com.au)

**E:** [info@tssm.com.au](mailto:info@tssm.com.au)

SAMPLE

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SAMPLE

## DETAILED STUDY 3.1: Einstein's special relativity

### Topic 1 –Maxwell's equations

#### Question 1

Complete the following statement:

James Maxwell's significant contribution to relativity was the prediction that the speed of light was  $3 \times 10^8 \text{ ms}^{-1}$ . However, his prediction about the speed of electromagnetic waves contradicted the principle of relativity primarily because...

- A. Maxwell found the aether, but was unable to accurately measure its relative speed
- B. The laws of physics depend on the frame of reference of the observer
- C. Maxwell's theory predicted a fixed value of the speed of light relative to the aether, which was at absolute rest. This would mean that various frames of reference would observe different speeds for light.
- D. The speed of light is not absolute

#### Question 2

Which of the following statements concerning Maxwell's prediction about the speed of light and other EM waves is most correct?

- A. The speed depends only on the electrical and magnetic properties of the medium
- B. The speed is independent of the electrical and magnetic properties of the medium
- C. The speed depends only on the elastic and density properties of the medium
- D. The speed is constant, regardless of the medium

**Topic 2 – Einstein's Special Relativity**

*Use the following information to answer Questions 3-4*

Tom and Jerry board two spaceships on Earth. The spaceships leave the Earth and accelerate up to a top speed of  $2.3 \times 10^8 \text{ m/s}$  relative to the Earth. Tom's spaceship travels in an opposite direction to Jerry's spaceship.

**Question 3**

According to **Newton's Laws of Motion** the speed of Jerry relative to Tom is:

- A.  $0 \text{ ms}^{-1}$
- B.  $2.3 \times 10^8 \text{ ms}^{-1}$
- C.  $4.6 \times 10^8 \text{ ms}^{-1}$
- D. None of the above

**Question 4**

According to **Einstein's special relativity** the time dilation factor of Jerry's spacecraft as measured by an observer on planet Earth is:

- A. 1.56
- B. 0.64
- C. 1
- D. 2.42

**Question 5**

Under what circumstances do Newton's Laws of Motion give a more accurate calculation of relative velocity between two objects?

- A. For speeds very much slower than that of light
- B. For speeds approximately equal to that of light
- C. For speeds in excess of that of light
- D. Never

**Question 6**

The Michelson-Morley experiment was designed to:

- A. Measure the speed the Earth moves through the aether
- B. Accurately measure the speed of light
- C. Test Einstein's theory of relativity
- D. Show it is impossible to travel faster than light