

Section 1: Basic principles of maths and physics applicable to accident reconstruction



iaea
THE INSTITUTE OF AUTOMOTIVE
ENGINEER ASSESSORS

Purpose:

At the end of this unit candidates will be able to demonstrate a knowledge and understanding of:

- Arithmetic including BODMAS
- Concepts of algebra
- Measuring gradients (include principles of Trigonometry)
- Acceptable precision
- Derivation of the equations of motion
- Newton's law of motion
- Force, weight and friction
- Incomplete wheel locking
- Trajectories
- Time to fall
- Momentum
- Scene measurement and plan drawing
- Professional report writing

Summary of learning outcomes	Number of questions in the examination*
Maths	
1.01 Arithmetic	Knowledge and application of these learning outcomes will be assessed in three questions
• Understand the rules of addition, subtraction, multiplication and division of numbers	
• Understand powers, squares and square root [including BODMAS]	
• Understand how to work with fractions	
• Understand ratios, proportions and percentages	
1.02 Concepts of algebra	
• Understand equations and transposition of equations	
Measuring gradients	
• Basic Principles of Trigonometry	
• Understand the common methods used to measure a gradient	
• Understand and demonstrate how to convert the various types of gradient measurement.	
1.03 Acceptable precision	
• Understand the acceptable precision to be applied in accident investigation cases	

Summary of learning outcomes	Number of questions in the examination*
Physics	
2.01 Derivation of the equations of motion	Knowledge and application of these learning outcomes will be assessed in three questions
<ul style="list-style-type: none"> • Understand the terms distance, displacement and velocity. 	
<ul style="list-style-type: none"> • Understand and apply the four equations of uniformly accelerate motion used in accident investigations 	
2.02 Newton’s law of motion	
<ul style="list-style-type: none"> • Understand Newton’s first law of motion 	
<ul style="list-style-type: none"> • Understand Newton’s second law of motion 	
<ul style="list-style-type: none"> • Understand Newton’s third law of motion 	
2.03 Force, Weigh and Friction	
<ul style="list-style-type: none"> • Understand the terms force, gravitational force, mass, weight and friction 	
<ul style="list-style-type: none"> • Understand the term coefficient of friction and the relevance to accident investigations 	
<ul style="list-style-type: none"> • Understand the effect of anti-lock brakes on stopping 	
<ul style="list-style-type: none"> • Understand the various effects of the nature and appearance of surfaces in relation to accident investigation 	
<ul style="list-style-type: none"> • Understand and recognise the different types of tyre marks and the impact to accident investigations 	
<ul style="list-style-type: none"> • Understand the effect of an incline on friction 	
<ul style="list-style-type: none"> • Understand the terms under and over steer. 	
2.04 Incomplete wheel locking	
<ul style="list-style-type: none"> • Understand how to identify at an accident investigation whether all wheels were fully braked 	
<ul style="list-style-type: none"> • Understand the forces applied when towing an unbraked trailer. 	
<ul style="list-style-type: none"> • Understand the forces involved in impacts with a stationary vehicle. 	
<ul style="list-style-type: none"> • Understand the effect of defective brakes on the braking forces. 	
<ul style="list-style-type: none"> • Understand and apply the equation for measuring braking force. 	
<ul style="list-style-type: none"> • Understand how braking forces differ in motorcycles 	
<ul style="list-style-type: none"> • Understand the operation and effect of limiter valves 	
<ul style="list-style-type: none"> • Understand the effect of a vehicle rotating on braking force 	
2.05 Trajectories	
<ul style="list-style-type: none"> • Understand and apply the equation for calculating trajectory. 	
<ul style="list-style-type: none"> • Understand the information required at the accident investigation to calculate trajectory 	
2.06 Time to fall	
<ul style="list-style-type: none"> • Understand and apply the equation for calculating the time taken for an object to fall a known distance. 	

Summary of learning outcomes	Number of questions in the examination*
2.07 Momentum <ul style="list-style-type: none"> • Understand and apply the law of conservation of linear momentum. • Understand and differentiate between inelastic collinear and non-collinear collisions. • Understand the effects of mass-ratio 	
Scene measurement, plan drawing and report writing	
3.01 Scene measurement and plan drawing	Knowledge and application of these learning outcomes will be assessed in one question.
<ul style="list-style-type: none"> • Understand the general rules involved in carrying out a manual survey. 	
<ul style="list-style-type: none"> • Understand and apply the general method of triangulation. 	
<ul style="list-style-type: none"> • Understand the alternative methods of measurement other than triangulation. 	
<ul style="list-style-type: none"> • Understand and apply the drawing methods used in a scale plan. 	
<ul style="list-style-type: none"> • Understand the common signs and symbols suitable for use in a scale plan. 	
3.02 Professional report writing	
<ul style="list-style-type: none"> • Understand the requirements of a professional report 	
<ul style="list-style-type: none"> • Understand the construction of a professional report 	
<ul style="list-style-type: none"> • Understand the six stages of preparing a professional report 	
<ul style="list-style-type: none"> • Understand the process of referencing within a professional report. 	

*The test specification is designed to be used as a guide and not absolute confirmation of the number of questions that will appear in the exam. The number of questions assessing each learning outcome will generally be within one of the number indicated.