



**Western Australian Certificate of Education  
ATAR course examination, 2017**

**Question/Answer Booklet**

**11 PHYSICS**

**Test 3 - Forces, Work  
and Energy**

Name

Student Number: In figures

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**Mark:**  $\frac{\quad}{36}$  In words

**Time allowed for this paper**

Reading time before commencing work: five minutes  
Working time for paper: fifty minutes

**Materials required/recommended for this paper**

***To be provided by the supervisor***

This Question/Answer Booklet  
Formulae and Data Booklet

***To be provided by the candidate***

Standard items: pens, (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the School Curriculum and Standards Authority for this course

**Important note to candidates**

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Short Answers					
Section Two: Problem-solving	4	4	50	36	100
Section Three: Comprehension					
Total					100

## Instructions to candidates

1. The rules for the conduct of examinations at Holy Cross College are detailed in the College Examination Policy. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer Booklet.
3. Working or reasoning should be clearly shown when calculating or estimating answers.
4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
5. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
  - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
  - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.
6. Answers to questions involving calculations should be **evaluated and given in decimal form**. It is suggested that you quote all answers to **three significant figures**, with the exception of questions for which estimates are required. Despite an incorrect final result, credit may be obtained for method and working, providing these are **clearly and legibly set out**.
7. Questions containing the instruction "estimate" may give insufficient numerical data for their solution. Students should provide appropriate figures to enable an approximate solution to be obtained. Give final answers to a maximum of two significant figures and include appropriate units where applicable.
8. Note that when an answer is a vector quantity, it must be given with magnitude and direction.
9. In all calculations, units must be consistent throughout your working.

1. A lift of mass  $3.65 \times 10^3 \text{ kg}$  holding eight people of combined mass  $5.10 \times 10^2 \text{ kg}$  is moving downwards at  $3.50 \text{ ms}^{-1}$ . It then decelerates to a stop at  $0.500 \text{ ms}^{-2}$ .

Calculate:

- (a) the tension in the lift cable while the lift moves at constant velocity. (3 marks)

- (b) the tension in the cable while the lift stops. (3 marks)

- (c) the apparent weight of a 70.0 kg person in the lift during the last part of its motion. (3 marks)

2. During a game of squash, the 35.0 g ball travelling at  $55.0 \text{ ms}^{-1}$  horizontally strikes the front wall at  $90.0^\circ$  to the surface and rebounds horizontally from the surface at  $25.0 \text{ ms}^{-1}$ . If the ball deforms and is in contact with the wall for 15.0 ms, calculate:

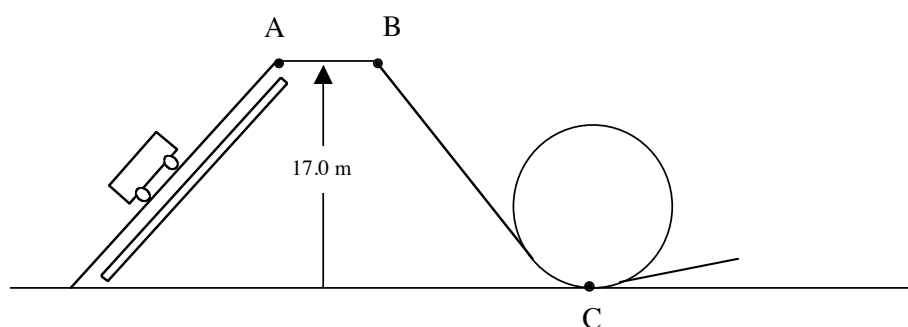
- (a) the change in momentum of the ball. (4 marks)

- (b) the impulse exerted on the ball. (2 marks)

(c) the force exerted by the wall on the ball.

(2 marks)

3. An electric motor rated at  $4.90 \times 10^5 \text{ W}$  is used to pull a roller coaster of total mass  $6.70 \times 10^3 \text{ kg}$  up to a height of  $17.0 \text{ m}$ , as shown in the diagram. At point A, the coaster has a speed of  $1.50 \text{ ms}^{-1}$ , which it maintains to point B. Assume no energy is lost due to friction.



- (a) Calculate the total energy of the roller coaster at point A.

(4 marks)

- (b) Theoretically, how long would it take the motor to lift the roller coaster up to point A?  
Assume the vehicle travels at a constant velocity. (3 marks)

- (c) If the coaster then rolls down to point C, what would be its speed? (3 marks)

4. In the railway marshalling yards, a carriage (mass  $5.00 \times 10^4 \text{ kg}$ ) was shunted against a stationary smaller carriage, which has half the mass of the larger carriage. If the heavier carriage was travelling at  $6.00 \text{ ms}^{-1}$  and the two join together on impact:
- (a) calculate the velocity with which the two carriages move off at after collision. (3 marks)
- (b) compare the kinetic energy of the larger carriage before the collision and the kinetic energy of both carriages after coupling. (4 marks)
- (c) has the principle of Conservation of Energy been obeyed? Explain your answer. (2 marks)