

**UNIVERSITY OF CAPE TOWN  
DEPARTMENT OF PHYSICS  
PHY1010W  
CLASS TEST 2: 12<sup>th</sup> May 2009**

**TIME: 90 MINUTES**

**FULL MARKS: 35**

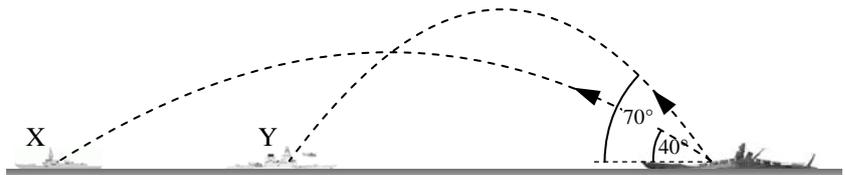
Answer Multiple choice on the separate sheet provided.  
All "rough" work and answers should be written on the question paper.

**Question 1 (Multiple Choice Questions, 15 marks)**

- Choose that answer which in your opinion is the correct or best answer and mark the appropriate block on the answer sheet provided.
- If you are *sure* of your answer, mark also the block containing the question mark.
- Use only a PENCIL on your answer sheet.
- In the case of a wrong answer erase the pencil mark completely.

1.1 A battleship simultaneously fires two shells at enemy ships. The shells are fired from the same type of gun, so they each have the same initial speed, but one gun is trained higher than the other. If the shells follow the parabolic trajectories shown, which ship (X or Y) gets hit first?

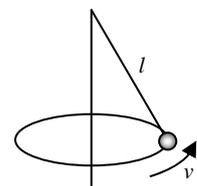
- A X
- B Y
- C both at the same time
- D More information is needed to answer the question.



1.2 A piece of ice slides down a  $45^\circ$  incline in twice the time it takes to slide down a frictionless slope at the same angle. The coefficient of kinetic friction between the ice and the incline is therefore

- A 0.25
- B 0.50
- C 0.75
- D 1.0

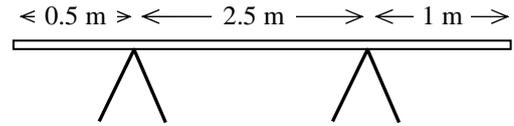
1.3 A ball suspended from a light string of length  $l$  is being whirled in a horizontal circle at a constant speed  $v$ , as shown.



Which one of the following free-body diagrams represents all the forces acting on the ball?

- A
- B
- C
- D

Questions 1.4 and 1.5 refer to a 4 m plank weighing 600 N which is supported on two trestles, as shown alongside.



1.4 The greatest weight which can be placed on one end without causing the plank to tilt is

- A 600 N                      B 1 200 N                      C 1 800 N                      D 2 700 N

1.5 The LEAST force required to tilt the plank is

- A 150 N                      B 200 N                      C 257 N                      D 600 N

$$5 \times 3 = \boxed{15}$$

### Question 2 (10 marks)

A player attempting to score kicks a football towards the goalposts at an angle of  $37^\circ$  with the horizontal and with an initial speed of 15 m/s. The goalkeeper standing at a distance of 30 m from the player in the direction of the kick starts running to meet the ball at the instant it is kicked.

- How fast must the goalkeeper run in order to catch the ball when it is 1.5 m above the ground while descending?
- What is the maximum height reached by the ball?
- What is the velocity of the ball just before the goalkeeper catches it?

### Question 3 (10 marks)

A 1500 kg car starts from rest and drives around a flat 50-m-diameter circular track. The forward force provided by the car's drive wheels is a constant 1000 N.

- What is the speed of the car at  $t = 10\text{s}$ ?
- What are the magnitude and direction of the car's acceleration at  $t = 10\text{s}$ ? (Give the direction as an angle from the  $r$ -axis.)
- If the coefficient of static friction of the wheels against the road is 1.0, at what time does the car begin to slide out of its circular path?