SOLUTIONS

HOLY CROSS COLLEGE
Life to the Full

Western Australian Certificate of Education
ATAR course examination, 2017

Question/Answer Booklet

11 PHYSICS

Test 2 - Motion

Name

Student Number: In figures | | | | | | | | |

Mark: ___/28 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	3	3	50	28	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 Year 12 student in Lyon 2 moved 1.30×10^2 m north (in 55.0 s) and then 1.50×10^2 m west (in 75.0 s) to get to room HH6 for her Mathematics class after doing Chemistry.

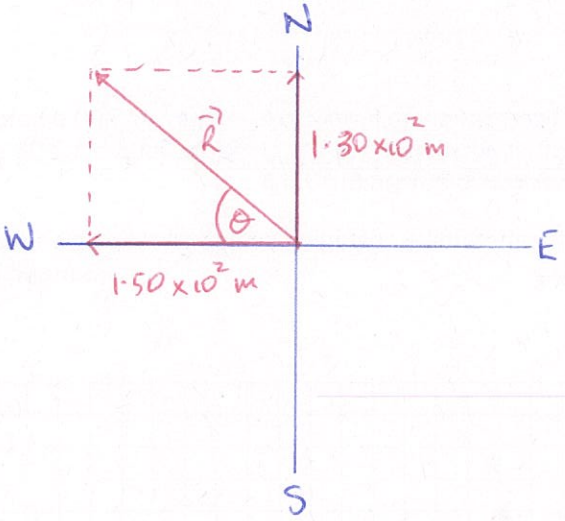
Determine (by calculation) the following.

(a) Total distance covered by the student. (1 mark)

$d = 1.30 \times 10^2 + 1.50 \times 10^2$

$= \underline{2.80 \times 10^2 \text{ m}}$ (1)

(b) Total displacement. (3 marks)



$\vec{R} = \sqrt{(1.30 \times 10^2)^2 + (1.50 \times 10^2)^2}$

$= 1.98 \times 10^2$ m (1)

$\tan\theta = \frac{1.30 \times 10^2}{1.50 \times 10^2}$

$\Rightarrow \theta = 40.9°$ (1)

$\therefore s = \underline{1.98 \times 10^2 \text{ m W } 40.9° \text{ N}}$ (1)

(c) Average speed for the entire motion. (2 marks)

$sp = \frac{d}{t}$

$= \frac{2.80 \times 10^2}{1.30 \times 10^2}$ (1)

$= \underline{2.15 \text{ ms}^{-1}}$ (1)

(d) Average velocity for the motion. (3 marks)

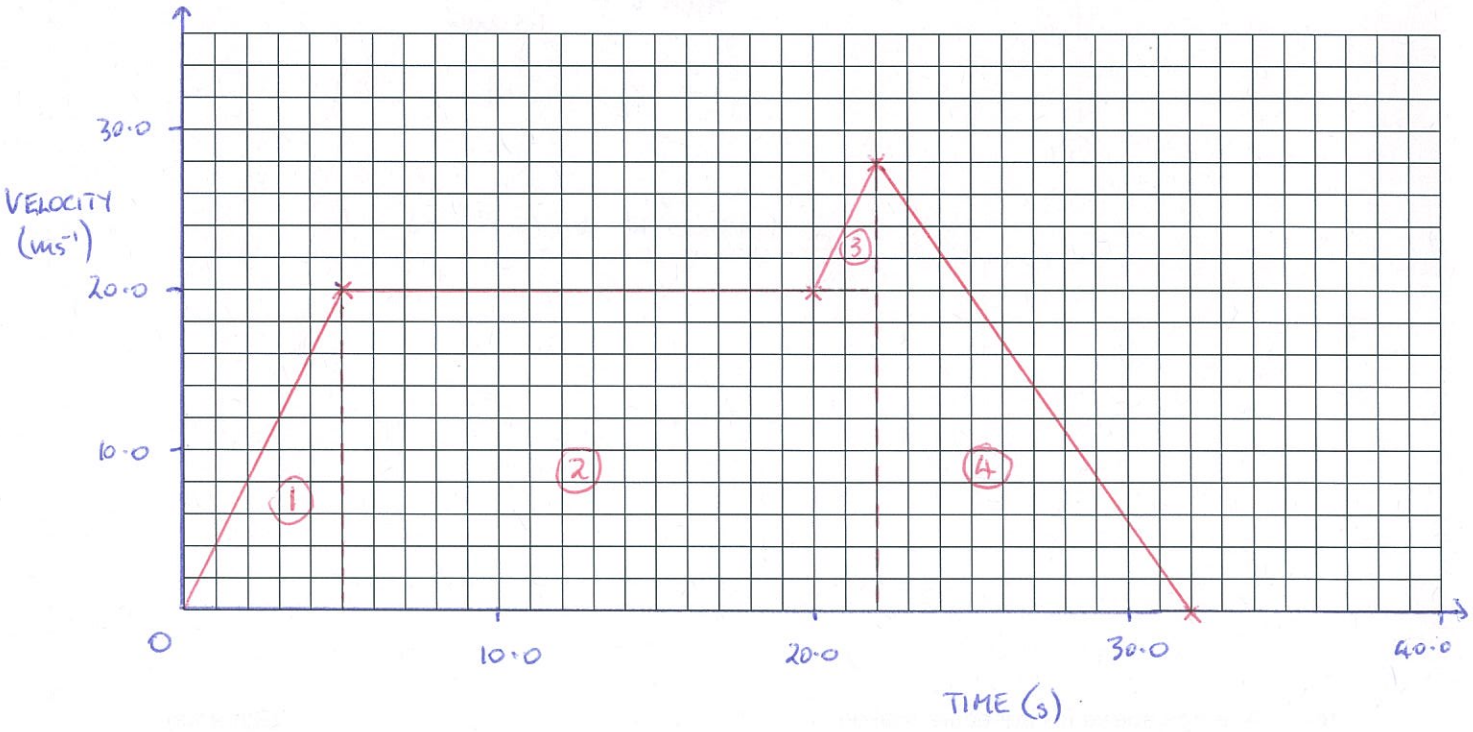
$$V = \frac{s}{t}$$

$$= \frac{1.98 \times 10^{2}}{1.30 \times 10^{2}} \quad (1)$$

$$= \underset{(1)}{1.52 \text{ ms}^{-1}} \quad \underset{(1)}{W\ 40.9^{\circ}\ N}$$

2. A motorbike is stationary at a set of traffic lights. It accelerates uniformly to 20.0 ms^{-1} in 5.00 s before maintaining its speed for another 15.0 s. At this point, it accelerates uniformly to 28.0 ms^{-1} in 2.00 s to pass a car before braking uniformly to come to a stop at a stop sign in 10.0 s.

(a) Draw a velocity-time graph for the motion of the motorbike, including scales and labels on the axes. (Assume the motion is in a straight line.) (3 marks)



Labels + units - 2 marks

Plotting - 1 mark

(b) From the graph, determine the distance between the lights and the stop sign. (4 marks)

s = area under the graph

$= \frac{1}{2}(5.00)(20.0) + (17.0)(20.0) + \frac{1}{2}(2.00)(8.00) + \frac{1}{2}(10.0)(28.0)$ (3)

$= 5.38 \times 10^{2}\ m$ (1)

(c) What is the deceleration of the motorbike as it comes to a stop? (2 marks)

$a = \frac{(0.0 - 28.0)}{(32.0 - 22.0)}$ (1)

$= -2.80\ ms^{-2}$ (1)

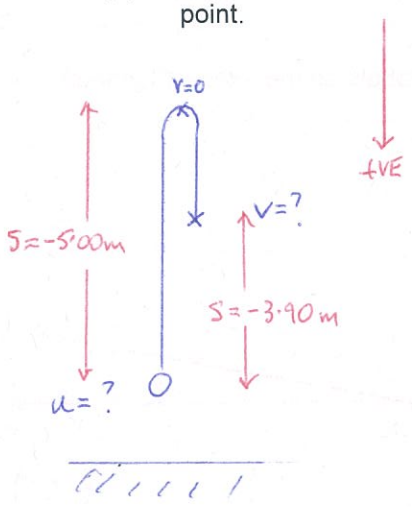
$\therefore\ a = 2.80\ ms^{-2}$ backwards

3. A boy on the first floor of the Trayning building yells down to his friend to throw back up his soccer ball that had fallen over the rail. His friend throws it vertically upwards and it goes to a height of 5.00 m above its release point before falling back down so that the boy catches it 3.90 m above its release point.

(Ignore any sideways movement.)

(a) Calculate the velocity of the soccer ball at release if it is to make it up 5.00 m above its release point. (3 marks)

Consider movement to the top



$v = 0\ ms^{-1}$

$u = ?$

$a = 9.80\ ms^{-2}$

$t = ?$

$s = -5.00m$ (1)

$v^2 = u^2 + 2as$

$\Rightarrow\ 0 = u^2 + 2(9.80)(-5.00)$ (1)

$\Rightarrow\ u = 9.90\ ms^{-1}$ upwards (1)

(b) What is the velocity of the soccer ball when it is caught? (If you didn't get an answer to part (a), assume the value is 11.0 ms^{-1}.) (2 marks)

Consider the whole motion

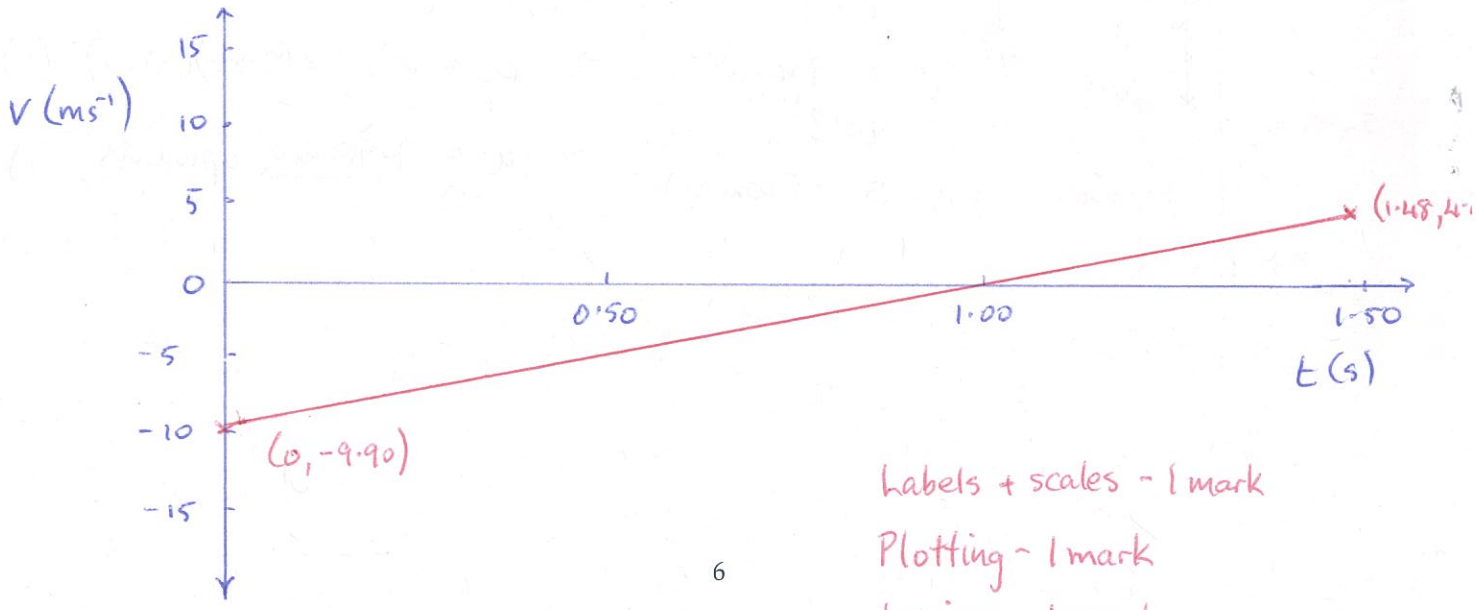
$v = ?$
$u = -9.90 ms^{-1}$
$a = 9.80 ms^{-2}$
$t = ?$
$s = -3.90 m$

$v^2 = u^2 + 2as$
$= (-9.90)^2 + 2(9.80)(-3.90)$ (1)
$\Rightarrow v = 4.64 ms^{-1}$ down (1)

(c) How long is the soccer ball in flight before it is caught? (2 marks)

$v = u + at$
$\Rightarrow t = \frac{v-u}{a}$
$= \frac{4.64-(-9.90)}{9.80}$ (1)
$= 1.48 s$ (1)

(d) Draw a velocity-time graph for this motion. Include scales and labels on the axes. (3 marks)



Labels + scales - 1 mark
Plotting - 1 mark
Linear - 1 mark