HOLY CROSS COLLEGE
*Life to the Full*

**Western Australian Certificate of Education**
**ATAR course examination, 2019**

**Question/Answer Booklet**

# 11 PHYSICS

## Test 1 - Motion

Name SOLUTIONS

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

**Mark:** $\frac{}{39}$ 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 | 5 | 5 | 10 | 5 | 13 |
| Section Two: Problem-solving | 4 | 4 | 50 | 34 | 87 |
| 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.

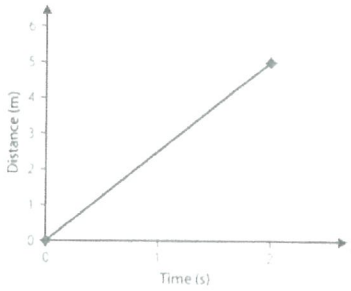
8. Note that when an answer is a vector quantity, it must be given with magnitude and direction.

9. In all calculations, units must be consistent throughout your working.

[1 mark each]

***For the following multiple-choice questions, please circle the correct answer.***

1. The graph shows the position of a particle while moving along a straight line. The speed of the particle at 1.5 s is closest to:




(a) 2.5 $ms^{-1}$.
(b) 4.0 $ms^{-1}$.
(c) 5.0 $ms^{-1}$.
(d) 10.0 $ms^{-1}$.

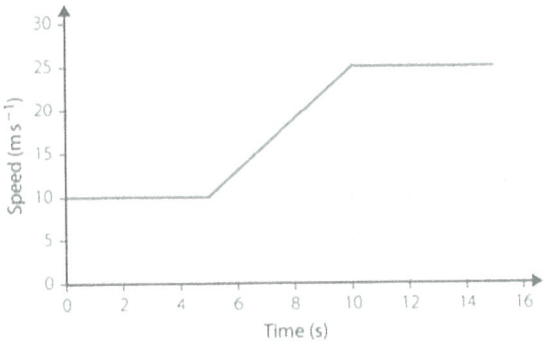
2. The speed of a cyclist changes from 4.00 $ms^{-1}$ to 10.0 $ms^{-1}$ in 3.00 s. What is the average acceleration of the cyclist?

(a) 2.00 $ms^{-2}$
(b) 3.00 $ms^{-2}$
(c) 6.00 $ms^{-2}$
(d) 10.0 $ms^{-2}$

3. How far will a car that accelerates uniformly from 12.0 $ms^{-1}$ to 20.0 $ms^{-1}$ in 4.00 s travel?

(a) 48.0 m
(b) 64.0 m
(c) 88.0 m
(d) 112 m

4. The graph below shows how the velocity of a car changes over time.




How far does the car travel between 4.00 s and 10.0 s?

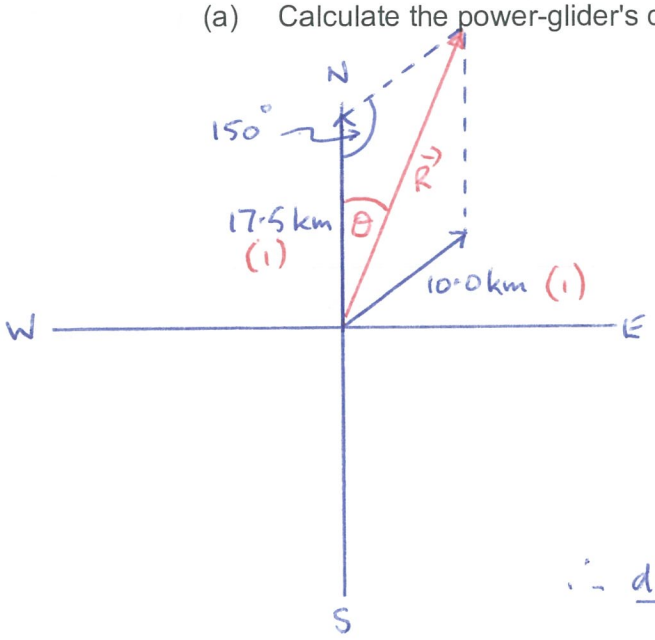
(a) 75.5 m
(b) 87.5 m
(c) 92.5 m
(d) 97.5 m

5. It takes Greg an hour to travel the first 80.0 km of a trip and an hour and a half for the remaining 135 km. What is Greg's average speed for the journey?

(a) 80.0 $kmh^{-1}$
(b) 85.0 $kmh^{-1}$
(c) 86.0 $kmh^{-1}$
(d) 88.0 $kmh^{-1}$

6. A power-glider competing in a cross-country event left the launch site and headed north at a steady 35.0 $kmh^{-1}$ for 30.0 minutes before heading N30.0°E at 30.0 $kmh^{-1}$ for another 20.0 minutes to cross the finish line.

(a) Calculate the power-glider's displacement in kilometres (*km*). (5 marks)




$\vec{R} = \sqrt{(17.5)^2 + (10.0)^2 - 2(17.5)(10.0)\cos 150°}$

$= 26.63$ km (1)

$\frac{26.63}{\sin 150°} = \frac{10.0}{\sin \theta}$

$\Rightarrow \theta = 10.82°$ (1)

$\therefore$ displacement = 26.6 km N 10.8°E (1)

(b) Determine the power-glider's average velocity in $kmh^{-1}$. (3 marks)

$V_{ave} = \frac{s}{t}$

$= \frac{26.63}{0.8333}$ (1)

$= 32.0 \text{ kmh}^{-1}$ N 10.8°E

(1) (1)

7. A small boat that can travel at 6.00 $ms^{-1}$ in still water heads straight across a 70.0 m wide river. The river has a current of 1.50 $ms^{-1}$ flowing downstream.

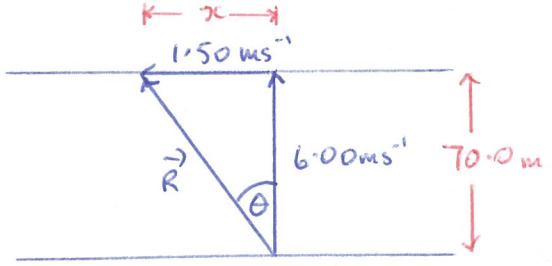
(a) How long does it take the boat to cross the river? (3 marks)

$$V_{across} = \frac{s_{across}}{t} \quad (1)$$

$$\Rightarrow t = \frac{70.0}{6.00} \quad (1)$$

$$= \underline{11.7\ s} \quad (1)$$

(b) How far downstream does the boat land on the opposite bank. ***Include a vector diagram in your answer***. (4 marks)




(1)

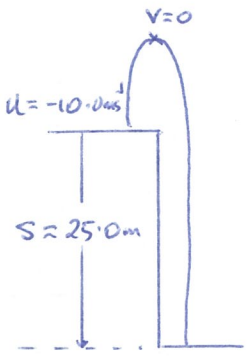
$$\tan\theta = \frac{1.50}{6.00} = \frac{x}{70.0} \quad (1)$$

$$\Rightarrow x = \frac{(70.0)(1.50)}{6.00} \quad (1)$$

$$= \underline{17.5\text{ m downstream}} \quad (1)$$

8. A stone is thrown vertically upwards at 10.0 $ms^{-1}$ from a 25.0 m high cliff above a valley and it falls to the ground at its base. Ignoring any horizontal movement. calculate:

(a) the time taken for the rock to reach its highest point. (3 marks)




↓ +VE Take movement to the top

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

$u = -10.0\ ms^{-1}$ (1) $\Rightarrow$ $v = u + at$

$a = 9.80\ ms^{-2}$ $\quad t = \frac{v-u}{a}$

$t = ?$ $\quad = \frac{0-(-10.0)}{9.80}$ (1)

$s = ?$ $\quad = 1.02\ s$ (1)

(b) the vertical velocity with which the rock strikes the ground at the base of the cliff. (3 marks)

↓ +VE Take the whole motion.

$v = ?$

$u = -10.0\ ms^{-1}$

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

$t = ?$

$s = 25.0\ m$

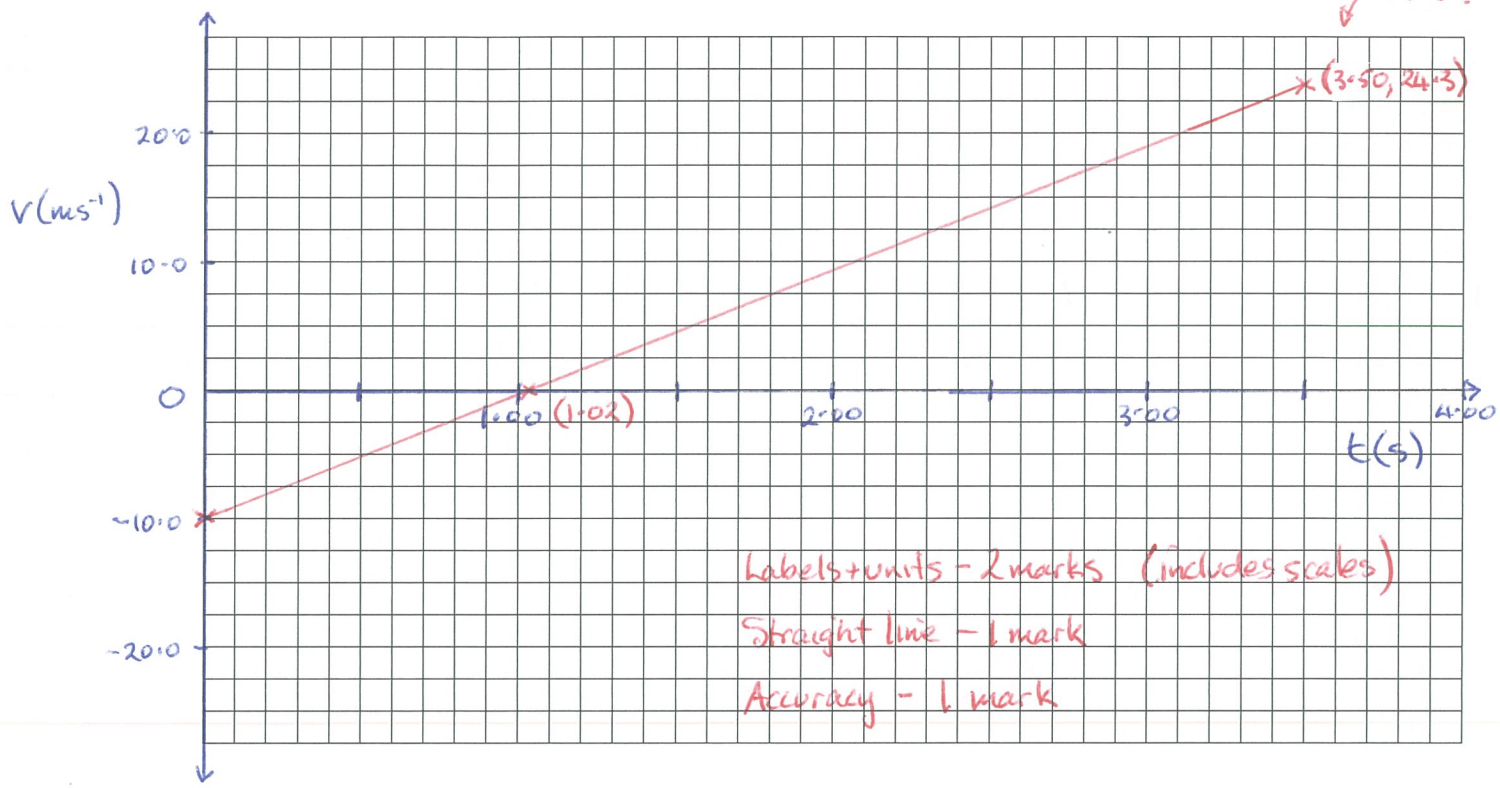
$v^2 = u^2 + 2as$

$= (-10.0)^2 + 2(9.80)(25.0)$ (1)

$= 5.90 \times 10^2$ (1)

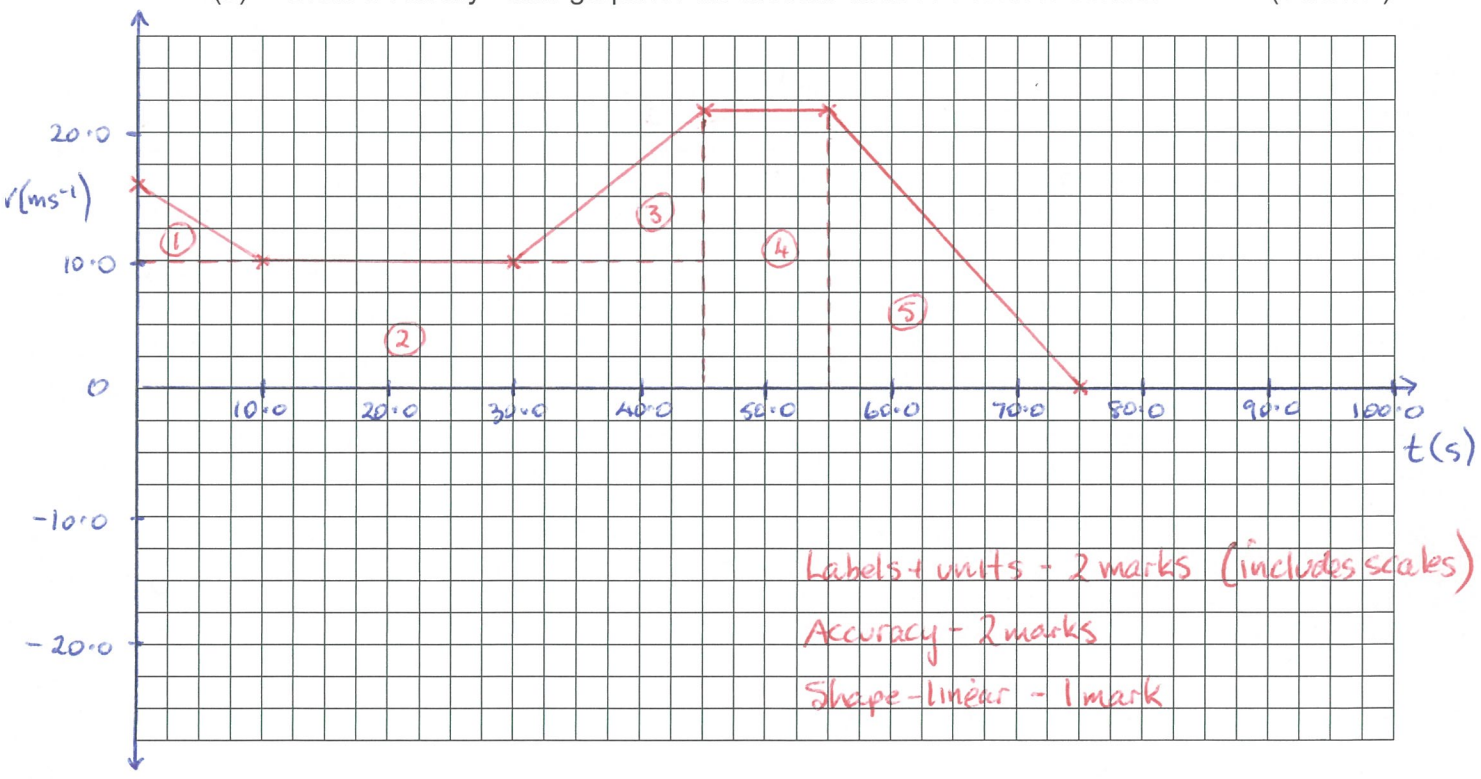
$\Rightarrow v = 24.3\ ms^{-1}$ down (1)

(c) Draw a velocity - time graph for the motion. Include accurate scales. (4 marks) Calculation of t.




9. A road-train is moving at 16.0 $ms^{-1}$ along Roe Highway when it applies its brakes uniformly for 10.0 s to slow to 10.0 $ms^{-1}$ for some road work. It maintains this speed for 20.0 s as it passes the workers, before accelerating uniformly up to 22.0 $ms^{-1}$ in 15.0 s. This speed is maintained for another 10.0 s before the road-train uniformly decelerates to a stop over 20.0 s, waiting for stationary traffic ahead. Assume the motion occurs in a straight line.

(a) Draw a velocity - time graph for the motion. Include accurate scales. (5 marks)



(b) Use the graph to determine the displacement of the car for the motion. (4 marks)

$s$ = area under graph

$= \frac{1}{2}(10.0)(6.00) + (45.0)(10.0) + \frac{1}{2}(15.0)(12.0) + (10.0)(22.0) + \frac{1}{2}(20.0)(22.0)$ (3)

$= 1.01 \times 10^{3}$ m (1)