Christ Church Grammar School

Science Department
Year 11 2021

ATAR PHYSICS
UNIT 2: MOTION and FORCES
TEST 1 - 2021

Student Name:

_____

Teacher: CJO JRM PCW
(Please circle)

Time allowed for this paper
Working time for paper: 40 minutes.

Instructions to candidates:

- You must include **all** working to be awarded full marks for a question.
- Answers should be expressed to three significant figures unless otherwise indicated.
- Marks may be deducted if diagrams are not drawn neatly with a ruler and to scale (if specified).
- Marks will be deducted for incorrect or absent units.
- **No** graphics calculators are permitted – scientific calculators only.

Mark:	/ 35
=	%

Question 1 **(11 marks)**

A car accelerates from 5.00 m s^{-1} East to 23.0 m s^{-1} East along a straight section of highway in a time of 4.79 s.

(a) Calculate the magnitude of the acceleration in this time.

(2 marks)

(b) Using two different methods, calculate the distance the car travels in this period. Write them clearly and separately in the space below.

(4 marks)

The car maintains its velocity of 23.0 m s^{-1} for 13.0 minutes before approaching a turnoff and needs to decelerate over 135 m to a speed of 12.0 m s^{-1} to safely navigate the turn.

(c) Calculate the time taken for the car to decelerate.

(2 marks)

(d) Calculate the total displacement of the car along the highway for the entire journey. (If you could not complete (b), use s = 158 m)

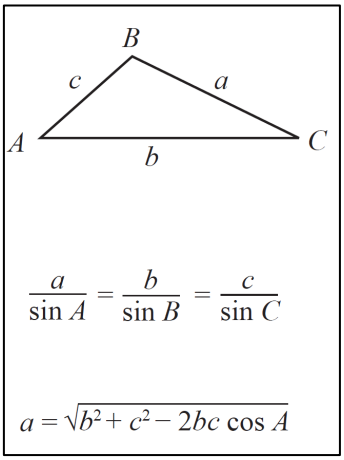
(3 marks)

Question 2 **(6 marks)**

A snooker ball approaches the side of the table at a speed of 0.237 m s^{-1} and strikes with an angle of 30.0 degrees to the edge. It then rebounds at the same speed with an angle of 30.0 degrees to the edge.

(a) Sketch a diagram (including labels) of the snooker ball collision with the edge of the table
(2 marks)

(b) Calculate the change in velocity of the ball.
Note: the sine and cosine rule are provided but is not necessary to solve.
(4 marks)



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a = \sqrt{b^2 + c^2 - 2bc\cos A}$$

Question 3 **(7 marks)**

A crane is lifting a sea container at a constant rate of 1.55 m s^{-1}. On top of the container is a loose spanner which subsequently falls off the container at a height of 32.4 m above the ground.

(a) Calculate the time taken for the spanner to reach the ground.
Note: the quadratic solution is provided but is not necessary to solve.

Quadratic equations

Given $ax^2 + bx + c = 0,\ x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

(4 marks)

(b) Calculate the height that the container would need to be above the ground for the final velocity of the spanner to be 62.5 m s^{-1}.

(3 marks)

Question 4 **(11 marks)**

In an orienteering competition, a competitor has planned their route to collect three checkpoints. From the starting location, they travel 6.15 km due North. They then travel 3.20 km on a bearing of East 35.0° South. The third checkpoint is 5.56 km away from the second on a bearing of West 10.0° South. Once at the third checkpoint, they find an injured competitor and send a distress signal.

(a) Calculate the displacement of the third checkpoint from the start.

(6 marks)

Once the competition organisers receive the distress signal, they organise a rescue party. After 6.00 minutes, they depart the starting line at a speed of 8.00 km/hr directly towards the third checkpoint. Straight after sending the distress signal, the original competitors commence moving the patient directly toward the starting location at a speed of 2.00 km/hr.

(b) Calculate the displacement (from the starting location) that the two parties will meet. (If you could not solve part (a), use s = 7.50 km.)

(5 marks)

END OF TEST