A-Level Physics

Paper 4

Unsolved Topical

Past Papers with Marking Schemes

All Variants

2014-2021

Title	A-LEVEL UNSOLVED TOPICAL PHYSICS PAPER 4
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PREFACE

Excellence in learning cannot be claimed without application of concepts in a dexterous way. In this regard one of the logical approach is to start in chunks; like chapter wise learning and applying the concept on exam based questions.

This booklet provides an opportunity to candidates to practice topic wise questions from previous years to the latest. Extensive working of Team MS Books has tried to take this booklet to perfection by collaborating with top of the line teachers.

We have added answer key / marks scheme at the end of each topic for the candidate to compare the hfis/her answer to the best.

MS Books strives to maintain actual spacing between consecutive questions and within options as per CAIE format which gives students a more realistic feel of attempting question.

Review, feedback and contribution in this booklet by various competent teachers of a subject belonging to renowned school chains make it most valuable resource and tool for both teachers and students.
With all belief in strength of this resource material I can confidently claim that it is worth in achieving brilliance.

Our sincere thanks and gratification to Mr. Syed Jabran Ali Kamran who took out special time to help compile and manage this booklet. We would also like to appreciate physics faculty for reviewing and indorsing it.

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PHYSICS PAPER 4

CONTENT TABLE

Circular Motion

Q7/P42/M/J/14

1 **(a)** Define the *radian*.

.....

.....

..... [2]

(b) A telescope gives a clear view of a distant object when the angular displacement between the edges of the object is at least 9.7×10^{-6} rad.

(i) The Moon is approximately 3.8×10^{5} km from Earth.
Estimate the minimum diameter of a circular crater on the Moon's surface that can be seen using the telescope.

diameter = ... km [2]

(ii) Suggest why craters of the same diameter as that calculated in **(i)** but on the surface of Mars are not visible using this telescope.

.....

.....

..... [2]

Q2/P42/O/N/14

2 A large bowl is made from part of a hollow sphere.

A small spherical ball is placed inside the bowl and is given a horizontal speed. The ball follows a horizontal circular path of constant radius, as shown in Fig. 2.1.

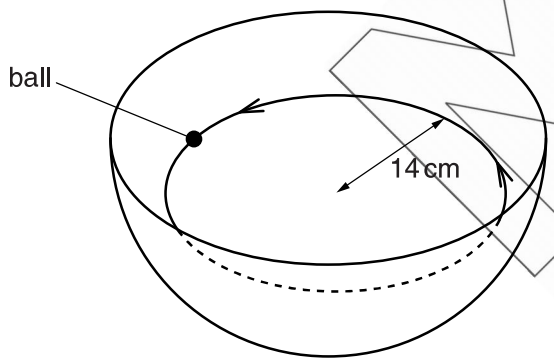


Fig. 2.1

The forces acting on the ball are its weight W and the normal reaction force R of the bowl on the ball, as shown in Fig. 2.2.

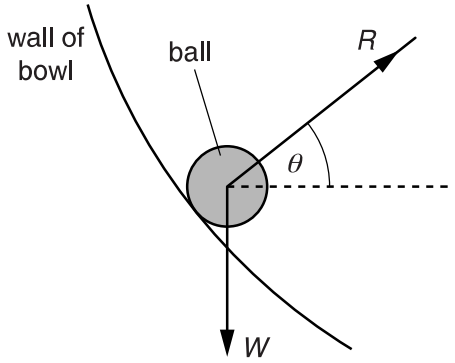


Fig. 2.2

The normal reaction force R is at an angle θ to the horizontal.

(a) (i) By resolving the reaction force R into two perpendicular components, show that the resultant force F acting on the ball is given by the expression

$$W = F \tan\theta.$$

[2]

(ii) State the significance of the force F for the motion of the ball in the bowl.

.....

..... [1]

(b) The ball moves in a circular path of radius 14 cm. For this radius, the angle θ is 28°.
Calculate the speed of the ball.

speed = ... $m\,s^{-1}$ [3]

Q1/41/O/N/21

3 **(a)** With reference to velocity and acceleration, describe uniform circular motion.

.....

.....

..... [2]

(b) Two cars are moving around a horizontal circular track. One car follows path X and the other follows path Y, as shown in Fig. 1.1.

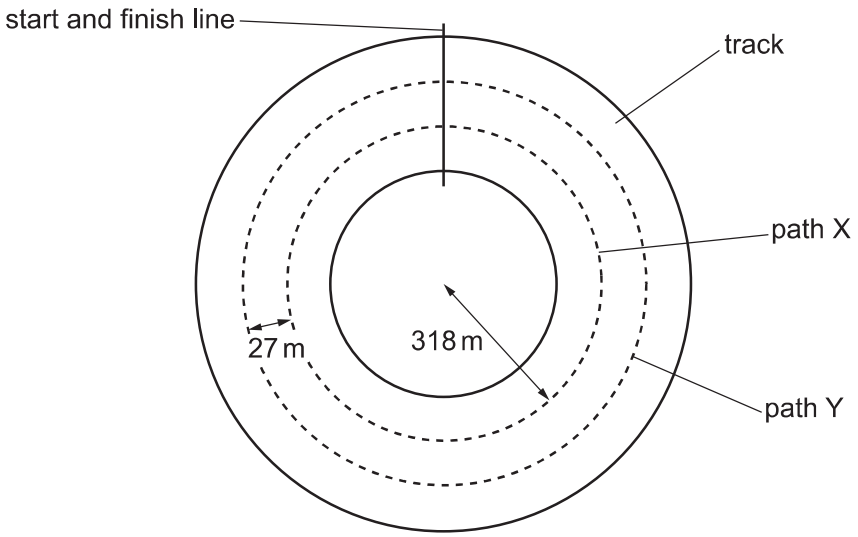


Fig. 1.1 (not to scale)

The radius of path X is 318 m. Path Y is parallel to, and 27 m outside, path X. Both cars have mass 790 kg. The maximum lateral (sideways) friction force F that the cars can experience without sliding is the same for both cars.

(i) The maximum speed at which the car on path X can move around the track without sliding is 94 m s^{-1}.

Calculate F.

F = ... N [2]

(ii) Both cars move around the track. Each car has the maximum speed at which it can move without sliding.

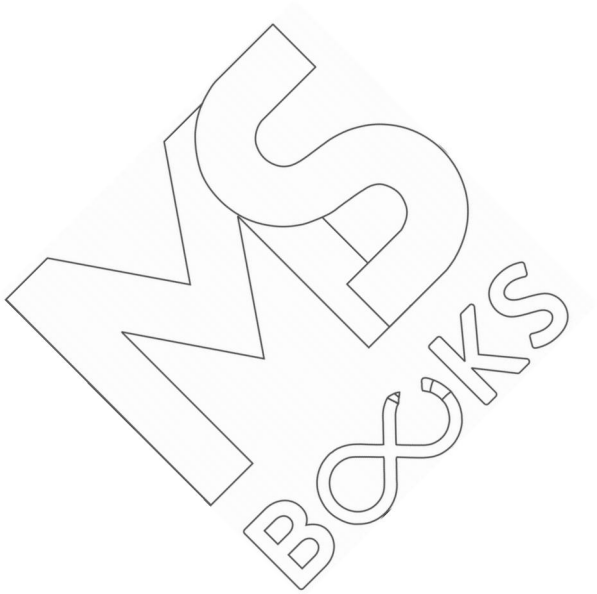
Complete Table 1.1, by placing one tick in each row, to indicate how the quantities indicated for the car on path Y compare with the car on path X.

Table 1.1

	Y less than X	Y same as X	Y greater than X
centripetal acceleration			
maximum speed			
time taken for one lap of the track			

[3]

[Total: 7]



Q7/P42/M/J/14

1 **(a)** angle subtended at the centre of a circle B1
by an arc equal in length to the radius B1 [2]

(b) **(i)** arc = distance × angle C1
diameter $= 3.8 \times 10^5 \times 9.7 \times 10^{-6}$
$= 3.7\,\text{km}$ A1 [2]

(ii) Mars is (much) further from Earth / away (*answer must be comparative)* B1
angle (at telescope is much) smaller B1 [2]

Q2/P42/O/N/14

2 **(a)** **(i)** $F = R\cos\theta$ M1
$W = R\sin\theta$ M1
dividing, $W = F\tan\theta$ A0 [2]
(max. 1 if derivation to final line not shown)

(ii) provides the centripetal force B1 [1]

(b) *either* $F = mv^2/r$ and $W = mg$
or $v^2 = rg/\tan\theta$ C1
$v^2 = (14 \times 10^{-2} \times 9.8)/\tan 28°$ C1
$= 2.58$
$v = 1.6\,\text{m s}^{-1}$ A1 [3]

Q1/41/O/N/21 **Q3**

Question	Answer	Marks
1(a)	constant speed **or** constant magnitude of velocity	**B1**
	acceleration (always) perpendicular to velocity	**B1**
1(b)(i)	$F = mv^2 / r$ **or** $v = r\omega$ **and** $F = mr\omega^2$	**C1**
	$F = 790 \times 94^2 / 318$ $= 22\,000$ N	**A1**
1(b)(ii)	centripetal acceleration: same	**B1**
	maximum speed: greater	**B1**
	time taken for one lap of the track: greater	**B1**