



Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE AS Physics

Topic 2: Mechanics

Test1

(Public release version)

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Additional Assessment Materials, Summer 2021

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General guidance to Additional Assessment Materials for use in 2021

Context

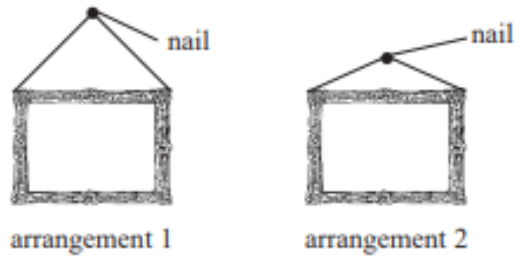
- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource is to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1

10 A thin wire of negligible mass is used to hang a picture on a wall. The wire is hung over a nail and can be attached to the picture using arrangement 1 or arrangement 2, as shown.



(a) Deduce which wire arrangement should be used to keep the tension in the wire as small as possible.

(4)

(b) It was observed that if the wire was not hung with its midpoint over the nail, as in Diagram 1, the picture moved and then remained in the position shown in Diagram 2.



Diagram 1



Diagram 2

Use the idea of moments to explain why.

(3)

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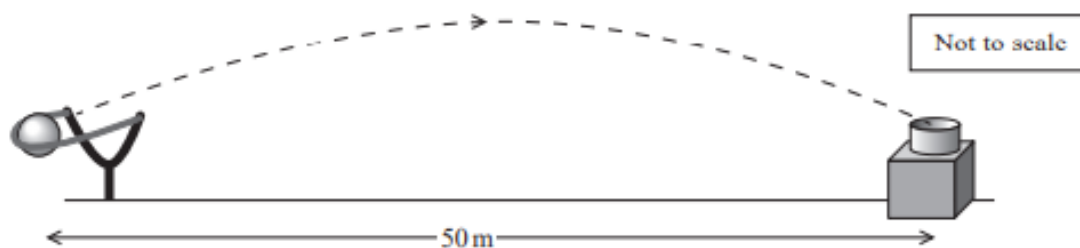
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(Total for Question 10 = 7 marks)

2

11 A fairground game requires the player to catapult a ball towards a target to score points.

The ball is required to reach a target a horizontal distance of 50 m away, at the same vertical height, as shown.



(a) The time taken for the ball to reach the target is 2.0 s.

Calculate the angle to the horizontal at which the ball is launched.

(4)

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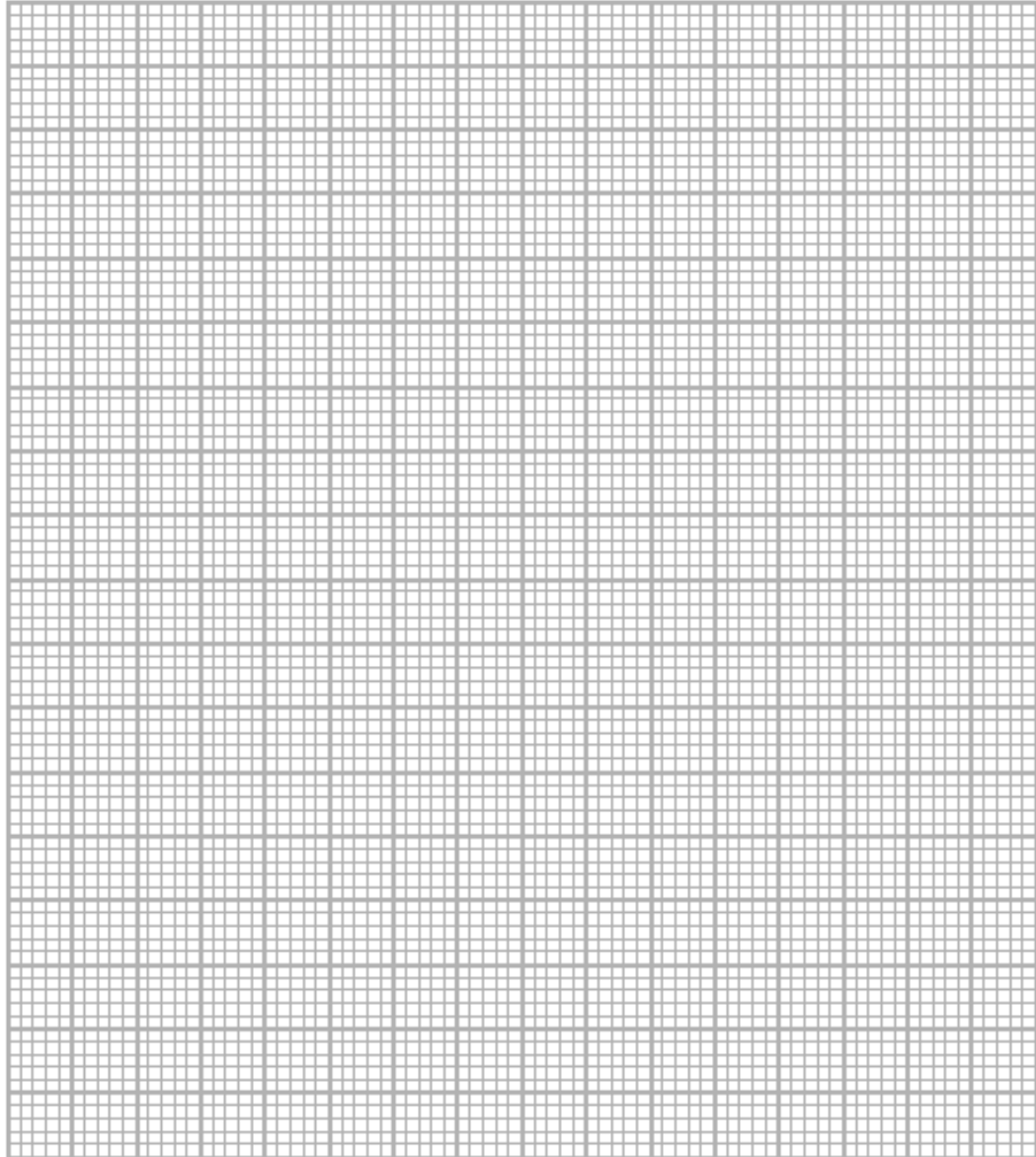
Angle to the horizontal =

- (b) During another launch, the catapult exerts a force on the ball of 9.0 N at 40° to the horizontal at the time of release.

Draw a labelled vector diagram to determine the resultant force acting on the ball at the time of release.

(4)

weight of ball = 2.0 N



Magnitude of resultant force =

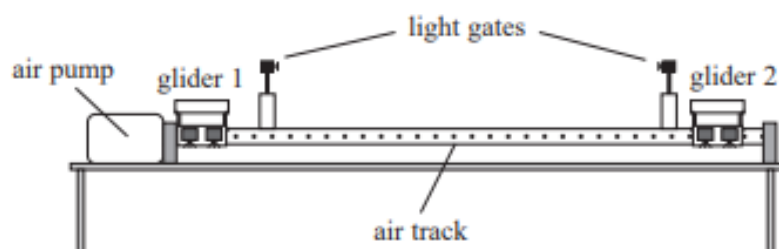
Angle of resultant force to the horizontal =

(Total for Question 11 = 8 marks)

3

12 A teacher uses a linear air track to provide a frictionless surface for two gliders, each of mass m . She uses this, with a pair of light gates connected to a computer, to investigate a collision between the gliders.

The gliders are each given a small push and travel towards the centre of the track. The gliders collide and move off together.



(a) The computer displays the velocity of the gliders as they pass through the light gates.

Calculate the velocity of the gliders after the collision, using the principle of conservation of linear momentum.

(3)

initial velocity of glider 1 = 0.30 m s^{-1} to the right

initial velocity of glider 2 = 0.70 m s^{-1} to the left

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Magnitude of velocity =

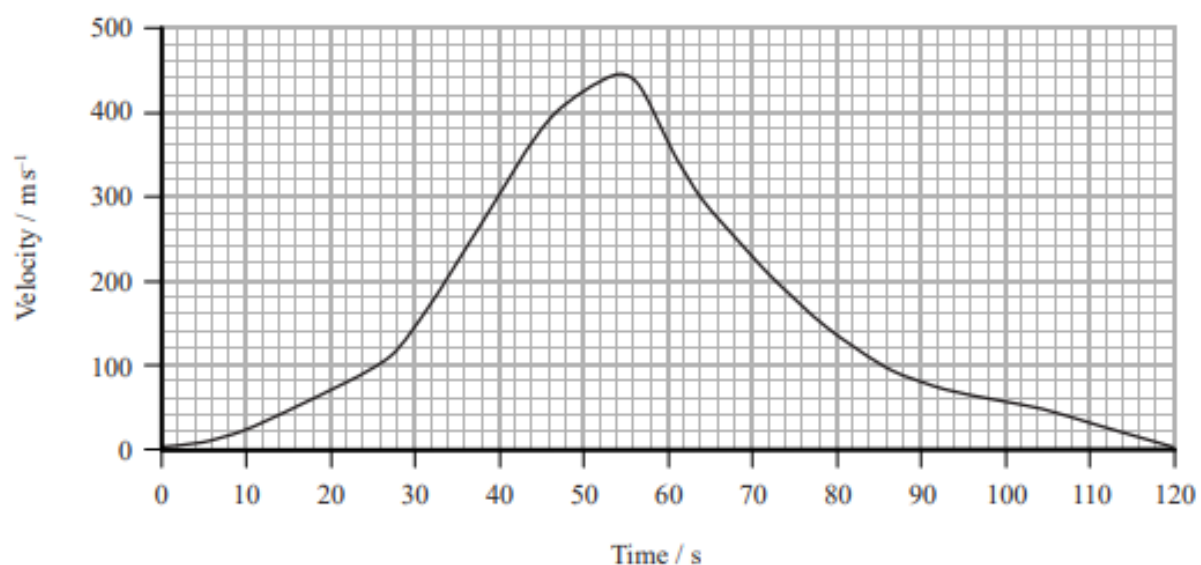
Direction of velocity =

4

- 14 The world land speed record of 341 m s^{-1} was set in October 1997. In an attempt to break this record, a new supersonic car has been developed called the Bloodhound.



The developers of the Bloodhound have used computer modelling to produce a velocity-time graph for the predicted motion of the car, on a straight track, during the record attempt.



- (a) A track of length 23 km is available for the record attempt.

Determine whether this track is long enough.

(3)

(b) The car has two different engines: a jet engine providing a thrust of 89kN and a rocket engine providing a thrust of 120kN.

(i) The jet engine runs throughout the car's acceleration stage. The rocket engine runs for only part of that stage.

State the time at which the rocket engine is started during the car's predicted motion.

(1)

(ii) Use the graph to determine the maximum positive acceleration of the car.

(2)

Maximum positive acceleration of the car =

(iii) Calculate a value for the frictional force acting on the car when the positive acceleration is a maximum.

(3)

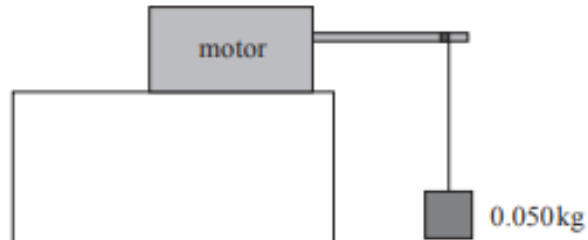
mass of car including fuel at this time = 7790 kg

Frictional force during maximum positive acceleration =

5

9 A motor lifts a block of mass 0.050kg at a constant velocity of 0.40 m s^{-1} .

The current in the motor is 85mA and the potential difference across it is 3.0V .



Calculate the efficiency of the motor.

(3)

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Efficiency of the motor =

(Total for Question 9 = 3 marks)

6

11 A motorist received a speeding penalty notice, from the police, for a short journey along 120m of road.

- (a) The car's specification states that the minimum time for the car to accelerate from 0 to 60 miles per hour is 9.5 seconds.

Show that the maximum value for the average acceleration of the car over 9.5 s is about 3 m s^{-2} .

$$1 \text{ mile} = 1600 \text{ m}$$

(2)

- (b) The police recorded a maximum speed for the car of 20 m s^{-1} .

The motorist knows that the speed at the start and at the end of the 120m journey was zero.

Assume that the car had:

- constant positive acceleration, equal to the value in part (a), for the first 60 m of the journey
- constant negative acceleration of the same magnitude for the final 60 m of the journey.

Determine whether the motorist should challenge the penalty notice.

(3)

(c) Explain why the assumptions about the acceleration in (b) may **not** be correct in practice. (2)

(Total for Question 11 = 7 marks)

TOTAL FOR PAPER IS 41 MARKS