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AS

FURTHER MATHEMATICS

Paper 2 Mechanics

7366/2M

Friday 17 May 2024 Afternoon

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]



J U N 2 4 7 3 6 6 2 M 0 1

MATERIALS

- **You must have the AQA Formulae and statistical tables booklet for A-level Mathematics and A-level Further Mathematics.**
- **You should have a graphical or scientific calculator that meets the requirements of the specification.**
- **You must ensure you have the other optional Question Paper/Answer Book for which you are entered (EITHER Discrete OR Statistics). You will have 1 hour 30 minutes to complete BOTH papers.**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions.**
- **You must answer each question in the space provided for that question. If you require extra space for your answer(s), use the lined pages at the**



end of this book. Write the question number against your answer(s).

- **Do NOT write on blank pages.**
- **Show all necessary working; otherwise marks for method may be lost.**
- **Do all rough work in this book. Cross through any work that you do not want to be marked.**

INFORMATION

- **The marks for questions are shown in brackets.**
- **The maximum mark for this paper is 40.**

ADVICE

- **Unless stated otherwise, you may quote formulae, without proof, from the booklet.**
- **You do not necessarily need to use all the space provided.**

DO NOT TURN OVER UNTIL TOLD TO DO SO



Answer ALL questions in the spaces provided.

1 An elastic string has modulus of elasticity 20 newtons and natural length 2 metres.

The string is stretched so that its extension is 0.5 metres.

Find the elastic potential energy stored in the string.

Circle your answer. [1 mark]

1.25 J

5.5

5 J

10 J



2 State the dimensions of impulse.

Circle your answer. [1 mark]

MLT⁻²

MLT⁻¹

MLT

MLT²

[Turn over]



3

A cyclist travels around a circular track of radius 20 m at a constant speed of 8 m s^{-1}

Find the angular speed of the cyclist in radians per second.

Circle your answer. [1 mark]

0.2 rad s^{-1}

0.4 rad s^{-1}

2.5 rad s^{-1}

3.2 rad s^{-1}



**4 IN THIS QUESTION USE
 $g = 9.8 \text{ m s}^{-2}$**

**A ball of mass 0.5 kg is
projected vertically upwards
with a speed of 10 m s^{-1}**

**4 (a) Calculate the initial kinetic
energy of the ball. [1 mark]**

[Turn over]



[Turn over]



- 4 (c) (i)** A student conducts an experiment to verify the accuracy of the result obtained in part (b).

They observe that the ball rises to a height of 4.4 m above the point of projection and concludes that this height difference is due to a resistance force, R newtons.

Find the total work done against R whilst the ball is moving upwards. [2 marks]



[Turn over]



**4 (c) (iii) Comment on the validity of the model used in part (c)(ii).
[1 mark]**

[Turn over]

5 Kang is riding a motorbike along a straight, horizontal road.

The motorbike has a maximum power of 75 000 W

The maximum speed of the motorbike is 50 m s⁻¹

When the speed of the motorbike is v m s⁻¹, the resistance force is $k v$ newtons.

Find the value of k

**Fully justify your answer.
[4 marks]**



6 Kepler's Third Law of planetary motion for the period of a circular orbit around the Earth is given by the formula,

$$t = 2\pi \sqrt{\frac{r^3}{Gm}}$$

where,

t is the time taken for one orbit

r is the radius of the circular orbit

m is the mass of the Earth

G is a gravitational constant.

**Use dimensional analysis to determine the dimensions of G
[4 marks]**



7 A single force, F newtons, acts on a particle moving on a straight, smooth, horizontal line.

The force F acts in the direction of motion of the particle.

At time T seconds,
 $F = 6e^t + 2e^{2t}$ where $0 \leq t \leq \ln 8$



[Turn over]



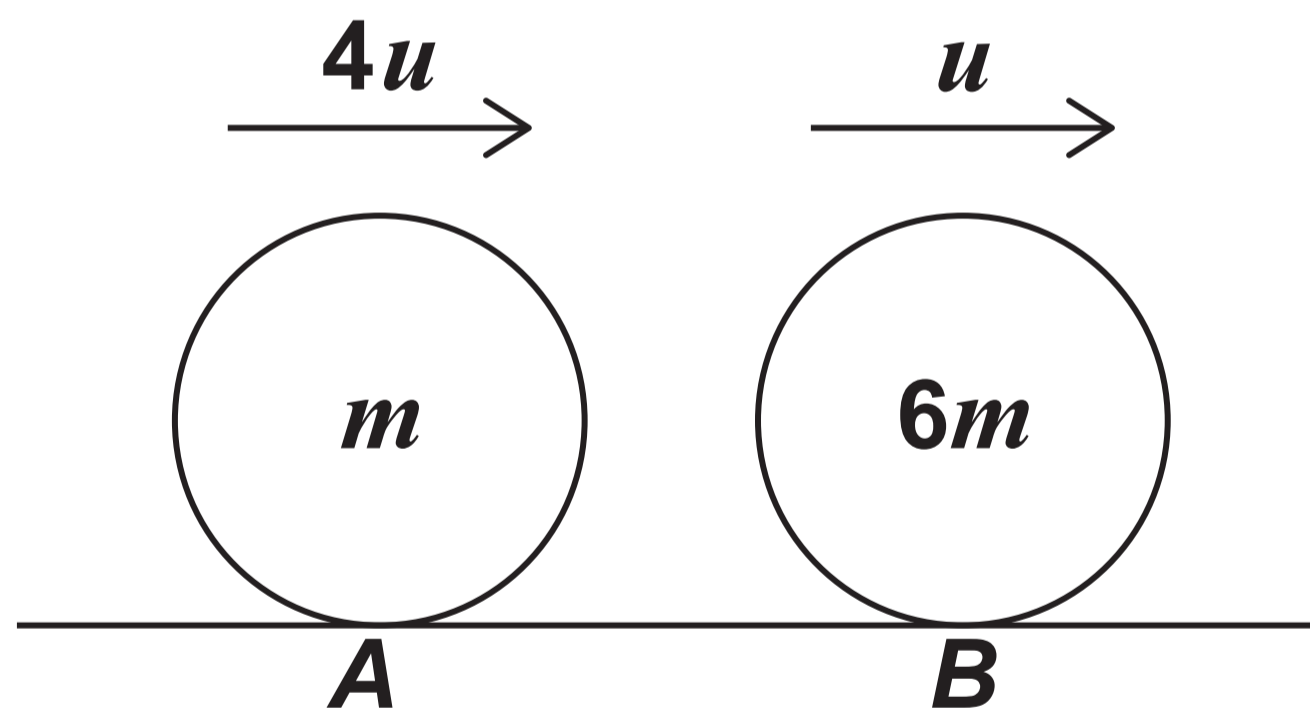
8

Two spheres, A and B , of equal size are moving in the same direction along a straight line on a smooth horizontal surface.

Sphere A has mass m and is moving with speed $4u$

Sphere B has mass $6m$ and is moving with speed u

The diagram shows the spheres and their velocities.



Subsequently A collides directly with B

The coefficient of restitution between A and B is e



- 8 (a) Find, in terms of m and u , the total momentum of the spheres before the collision. [1 mark]

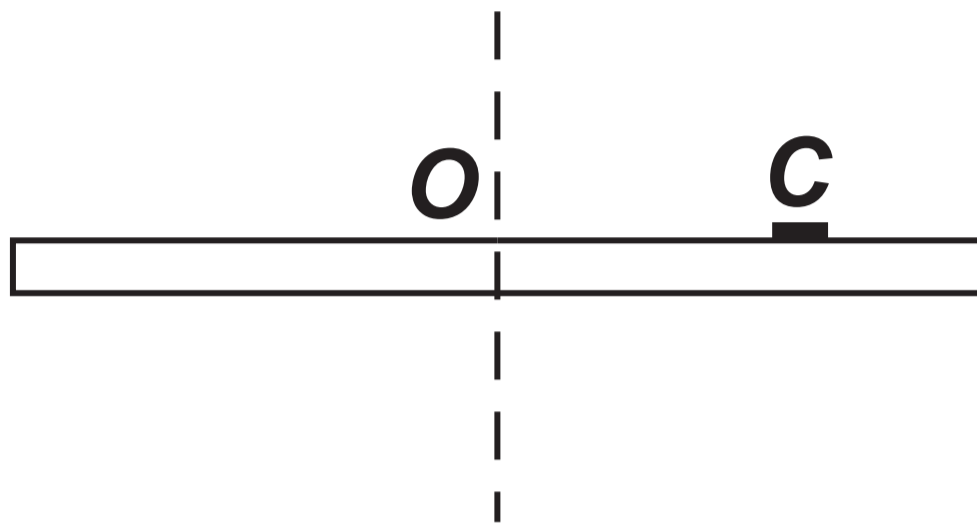
- 8 (b) Show that the speed of B immediately after the collision

is $\frac{u(3e + 10)}{7}$ [4 marks]

[Turn over]



- 9 A small coin is placed at a point C on a rough horizontal turntable, with centre O , as shown in the diagram below.



The mass of the coin is 3.6 grams.

The distance OC is 20 cm

The turntable rotates about a vertical axis through O , with constant angular speed ω radians per second.





9 (c) State one modelling assumption you have made to answer part (b). [1 mark]

END OF QUESTIONS



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For Examiner's Use	
Question	Mark
1	
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TOTAL	

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3 6



2 4 6 A 7 3 6 6 / 2 M