DULWICH COLLEGE
FOUNDED 1619

Upper School Entrance Examination
Specimen Paper
Physics

Your Last Name	
Your First Name	
Date of Birth	
Current School	

for examiners' use	
Question	**Marks**
1	*/9*
2	*/10*
3	*/10*
4	*/9*
5	*/10*
Total	*/48*

Time allowed for this paper 45 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Questions may be attempted in **any order**.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**

Information

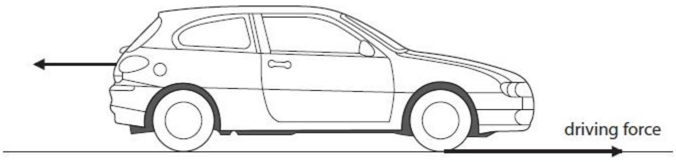
- The maximum mark for this paper is **48**.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.
- Quality of Written Communication will be assessed in all answers.

- **Assume g = 10 N/kg unless otherwise stated**

Q1.

(a) A car accelerates along a level road.

The diagram shows some of the horizontal forces acting on the car as it accelerates.



(Source: DEEWI114481 © father/Shutterstock)

(i) A driving force acts on the car, as shown in the diagram.
State the name of the other force shown in the diagram.

(1)

....

(ii) State the formula linking unbalanced force, mass and acceleration.

(1)

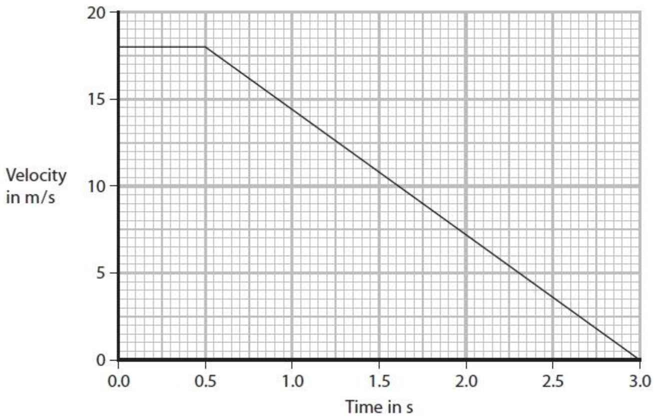
(iii) The unbalanced force acting on the car is 2900 N.
The mass of the car is 1200 kg.
Calculate the acceleration of the car.

(2)

acceleration = ... m/s^2

(b) The driver sees an obstacle in the road and applies the brakes.

The driver has a reaction time of 0.5 s. He applies the brakes for 2.5 s.
The graph shows how the velocity of the car changes from when the driver sees the obstacle until the car stops.



(i) Describe how the thinking distance is affected by the condition of the car's brakes and the speed of the car.

(2)

condition of brakes ....

....

speed of car ....

....

(ii) Use the graph to calculate the braking distance.

(3)

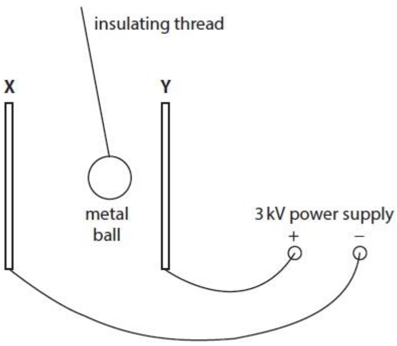
braking distance = ... m

(Total for question = 9 marks)

Q2.

This question is about a demonstration to show the link between current and charge.

The diagram shows two metal plates, X and Y, with a metal ball moving between them.



(a) The two metal plates have no charge before the power supply is connected.

When plate Y is connected to the positive terminal of the power supply, the plate becomes positively charged.
Explain how plate Y gains a positive charge.

(2)

....

....

....

....

(b) (i) The metal ball becomes positively charged when it touches plate Y.

The metal ball then moves away from plate Y towards plate X.
Explain why the metal ball moves away from plate Y.

(2)

....

....

....

....

(ii) Give a reason why the ball is made of metal.

(1)

....

....

(c) When the metal ball moves away from plate Y to plate X, a charge of 5.1×10^{-6} C is transferred.

(i) State the formula linking charge transferred, current and time taken.

(1)

(ii) Calculate the current if the metal ball takes 0.45 seconds to travel from plate Y to plate X.

(2)

current = ... A

(iii) Suggest why the current increases if the voltage of the power supply is increased.

(1)

....

....

....

(iv) Give the name of the apparatus that can be used to measure current.

(1)

....

(Total for question = 10 marks)

Q3.

Diagram 1 shows a gate fitted with a spring mechanism.

The spring mechanism shuts the gate automatically.

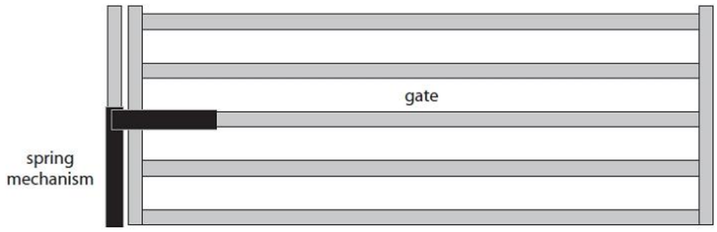
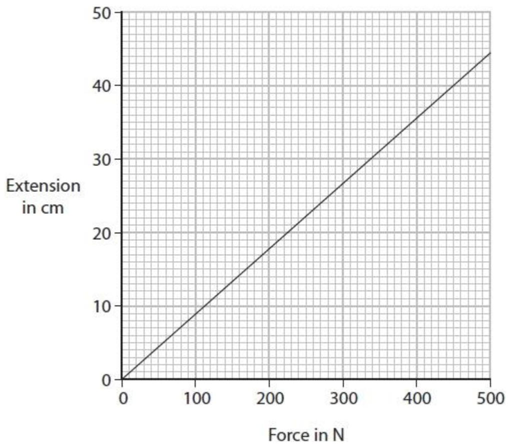


Diagram 1

(a) The graph shows some data from an investigation into how the extension of the spring changes with an increasing force.



Describe the relationship shown by the graph.

(2)

....

....

....

....

(b) Diagram 2 shows the gate viewed from above.

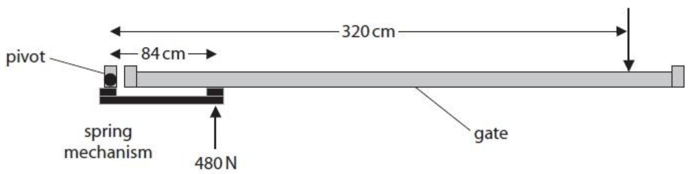


Diagram 2

The force the spring exerts on the gate is 480 N.
Show that the moment of the force the spring exerts on the gate is about 400 Nm.

(2)

(c) The force, F, is the minimum force needed to start opening the gate.

Calculate the magnitude of force F.

(4)

force F = ... N

(d) The spring is removed for testing.

Explain what will happen to the spring if the force applied to extend the spring is too large.

(2)

....

....

....

....

(Total for question = 10 marks)

Q4.

Scientific balloons are tested in a laboratory before they are used.

(a) In the first test the pressure of the air inside the balloon is 120 kPa.

The balloon is sealed and has a volume of 92 m^3.

(i) The pressure of the air inside the balloon is reduced to 64 kPa by reducing the external air pressure.

Calculate the new volume of the balloon.

(2)

volume = ... m^3

(ii) Give an assumption that is made in the calculation.

(1)

....

(b) The pressure of the air in the balloon is returned to 120 kPa.

The temperature of the air inside the balloon is 290 K.

The balloon is tested again, changing the temperature of the air and keeping the volume of the balloon constant.

(i) Explain why the pressure of the air in the balloon decreases when the temperature of the air decreases.

(3)

....

....

....

....

....

....

....

(ii) Calculate the temperature of the air when the pressure of the air in the balloon is 64 kPa.

Give your answer in kelvin.

(3)

temperature = ... K

(Total for question = 9 marks)

Q5.

The photograph shows Callisto, a moon of the planet Jupiter.

(Source: © Elena11/Shutterstock)

(a) In the space below, draw a labelled diagram to show how Callisto orbits Jupiter.

(2)

(b) Callisto orbits Jupiter at an orbital radius of 1 880 000 km and with an orbital period of 400 hours.

Calculate the orbital speed of Callisto in km/s.
Give your answer to 3 significant figures.

(4)

orbital speed = ... km/s

(c) Callisto has a gravitational field strength of 1.2 N/kg at its surface.

The Earth's moon has a gravitational field strength of 1.6 N/kg at its surface.

(i) Callisto has a larger mass than the Earth's moon.

Suggest why Callisto has a lower gravitational field strength than the Earth's moon.

(1)

....

....

....

(ii) An object has a weight of 59 N on the surface of the Earth's moon.

Calculate the weight of the same object if it were on the surface of Callisto.

(3)

weight = ... N

(Total for question = 10 marks)

END OF PAPER