AS and A-level MATHS

Forces 1

Specification content coverage: R1, R2, R3

In this test you will be assessed on:
- using Newton's first and second laws
- using weight and motion in a straight line under gravity
- using gravitational acceleration, g.

The test comprises two sections. The questions in section A will test you on the basics of the topic. Those in section B require a bit more thinking.

Section A: The basics

1 (a) **In this question, use $g = 10$ m s^{-2}.**

A boy throws a ball vertically upwards into the air with a velocity of 8 m s^{-1} and catches it again at the same point.

Calculate the greatest height the ball reaches.

[2 marks]

1 (b) Find the speed and direction of the ball after 0.3 seconds.

[3 marks]

1 (c) Find the total time the ball is in the air.

[3 marks]

2 A particle of mass 800 g starts from rest, accelerates constantly for 4 s and achieves a velocity of 5m s^{-1}.

2 (a) Find the constant acceleration of the particle.

[2 marks]

2 (b) Hence calculate the magnitude of the force acting on the particle.

[2 marks]

3 (a) A car of mass 600 kg pulls a caravan of mass 800 kg along a straight horizontal road.

The car experiences a resistance force of 500 N and the caravan experiences a resistance force of 900 N.

3 (a) Given that the car and caravan accelerate at 1.2 m s^{-2}, calculate the driving force of the car.

[3 marks]

3 (b) Calculate the force the car exerts on the caravan.

[2 marks]

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Section B: A bit more thinking

4 Two particles, *A* and *B*, connected by a light inextensible string are at rest on a smooth horizontal table. The mass of particle *A* is 3 kg and the mass of particle *B* is 5 kg.

A force of 7 N is applied to particle *B* in the direction of *AB*.

Calculate the tension in the string and the acceleration of the particles.

[4 marks]

5 **In this question, use $g = 9.8$ m s^{-2}.**

A ball is thrown vertically upwards at 12 m s^{-1}. Two seconds later another ball is thrown vertically upwards from the same point at 9 m s^{-1}.

Find the height at which the balls collide.

[4 marks]

6 A girl pushes a trolley of mass 7 kg from rest along a straight horizontal road with a force of 12 N. There is a resistance force of 2 N.

The girl lets go of the trolley and it slows down under the resistance force until it stops.

The trolley has travelled 45 m in total.

Find the time for which the girl was pushing the trolley.

[7 marks]

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