P5F Forces: Foundation Tier Practice

AQA 8463 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A push or a pull on an object is called a force. Forces can change how fast an object is moving or change the direction of motion.

State what is meant by the term "force".

(Total for Question 1 is 1 mark)

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2 Forces are measured using an SI unit named after a scientist who studied motion.

Give the name and symbol of the SI unit used for force.

(Total for Question 2 is 1 mark)

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3 Some forces act without touching the object, such as magnetic forces, while others require contact, such as a push from a hand.

A magnet attracts a paperclip without touching it. State whether this force is a contact force or a non-contact force.

(Total for Question 3 is 1 mark)

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4 A child has mass 6.0 kg. Use $g = 10\ m/s^2$ for calculations.

Calculate the weight of the child. Show the equation and working.

(Total for Question 4 is 2 marks)

5 Two horizontal forces act on a toy car along the same line: 8 N to the left and 3 N to the right.

Calculate the resultant force on the toy car and state its direction.

(Total for Question 5 is 2 marks)

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6 An object moving at constant speed in a straight line has no change in its motion.

State whether the forces on an object are balanced or unbalanced when it moves at constant speed in a straight line.

(Total for Question 6 is 1 mark)

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7 A small trolley of mass 4.0 kg accelerates at 3.0 m/s^2.

Use the equation F = m x a to calculate the resultant force on the trolley. Show your working.

(Total for Question 7 is 2 marks)

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8 A delivery van has forward driving force 400 N and frictional forces of 200 N opposing its motion. The mass of the van plus load is 800 kg.

Calculate the resultant force on the van and then calculate its acceleration. Show all steps and units.

(Total for Question 8 is 2 marks)

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9 A spring stretches 8.0 cm when a force of 4.0 N is applied.

Calculate the spring constant k in N/m. Use k = F / x and show your working.

(Total for Question 9 is 2 marks)

10 When a material is stretched it may return to its original length. There is a point beyond which it will not return to its original length when the force is removed.

Give the term used for the point beyond which a spring will not return to its original length.

(Total for Question 10 is 1 mark)

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11 A force of 200 N is applied uniformly to a flat circular plate of area 0.50 m^2.

Calculate the pressure on the plate. Use pressure = force / area and show your working.

(Total for Question 11 is 2 marks)

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12 A skydiver of mass 70 kg falls and reaches terminal velocity when the air resistance upwards equals the weight downwards. At terminal velocity the forces are balanced.

Describe what is meant by terminal velocity and explain why the skydiver does not accelerate at terminal velocity.

(Total for Question 12 is 2 marks)

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13 Pressure in a liquid increases with depth. A small cube of area 0.020 m^2 is placed on the base of a tank where the water depth above the base is 1.5 m. Density of water = 1000 kg/m^3. Use g = 10 m/s^2.

Calculate the pressure due to the water at the base under the cube. Use $p = \rho \times g \times h$ and show your working.

(Total for Question 13 is 2 marks)

14 A cyclist brakes to avoid hitting a dog. The cyclist of mass 60 kg slows from 8.0 m/s to 0 m/s over a distance of 10 m. Use the work-energy principle where work done by the braking force equals change in kinetic energy.

Explain how to calculate the average braking force exerted by the brakes. Include the relevant equation(s), the substitution with numbers and the final calculation. State any assumptions you use. This question is worth 6 marks.

(Total for Question 14 is 6 marks)

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15 A book of mass 1.2 kg rests on a table. The book does not accelerate vertically because the upward support force from the table balances the weight of the book. Use $g = 10\ m/s^2$.

Calculate the weight of the book and state the magnitude of the support force from the table. Show your working.

(Total for Question 15 is 3 marks)

Mark scheme · P5F Forces: Foundation Tier Practice

Question 1

- **B1** a push or a pull on an object, or something that changes the motion of an object, oe
- **Answer: A push or a pull on an object (something that changes an object's motion).**

Question 2

- **B1** newton or N cao
- **Answer: Newtons (N).**

Question 3

- **B1** non-contact cao
- **Answer: Non-contact.**

Question 4

- **M1** substitutes into W = m x g (W = 6.0 x 10)
- **A1** 60 N cao
- **Answer: 60 N**

Question 5

- **M1** subtracts smaller force from larger to find resultant (8 - 3 = 5)
- **A1** 5 N to the left cao
- **Answer: 5 N to the left**

Question 6

- **B1** balanced cao
- **Answer: Balanced.**

Question 7

- **M1** substitutes into F = m x a (F = 4.0 x 3.0)
- **A1** 12 N cao
- **Answer: 12 N**

Question 8

- **M1** finds resultant force by subtraction: 400 - 200 = 200 N
- **A1** uses a = F / m to get 200 / 800 = 0.25 m/s^2 cao
- **Answer: Resultant force = 200 N; acceleration = 0.25 m/s^2**

Question 9

- **M1** converts extension to metres and substitutes: k = 4.0 / 0.08
- **A1** 50 N/m cao
- **Answer: 50 N/m**

Question 10

- **B1** elastic limit cao
- **Answer: Elastic limit.**

Question 11

- **M1** substitutes into p = F / A: p = 200 / 0.50
- **A1** 400 Pa cao
- **Answer: 400 Pa**

Question 12

- **M1** defines terminal velocity: constant speed reached when downward weight equals upward air resistance
- **A1** states that resultant force is zero so no acceleration (forces balanced) cao
- **Answer: Terminal velocity is the constant speed when air resistance equals weight; the resultant force is zero so the skydiver does not accelerate.**

Question 13

- **M1** substitutes into p = ρ x g x h: p = 1000 x 10 x 1.5
- **A1** 15000 Pa cao
- **Answer: 15000 Pa**

Question 14

- **Level 3** (5-6): A clear, logical explanation that uses the work-energy principle or energy equations correctly, substitutes the numbers, shows the calculation and gives the braking force with correct unit. Any reasonable assumption is stated.
- **Level 2** (3-4): Partial explanation with either correct energy change calculation or correct use of work = force x distance, and one correct substitution leading to a magnitude for force, but missing one clear link or unit.
- **Level 1** (1-2): Simple statements, such as giving only one equation or a qualitative answer, with minimal or incorrect use of numbers.
- **Indicative content:**
  - Work done by braking force = change in kinetic energy
  - Initial kinetic energy = 1/2 x m x v^2 = 0.5 x 60 x 8.0^2 = 0.5 x 60 x 64 = 1920 J
  - Final kinetic energy = 0 J, so change in energy = 1920 J
  - Work = force x distance, so force = work / distance = 1920 / 10 = 192 N
  - Assumption: braking force is approximately constant over the distance; ignore frictional losses other than braking

Question 15

- **M1** substitutes into W = m x g: W = 1.2 x 10
- **A1** 12 N cao
- **A1** states support force is 12 N upward cao
- **Answer: Weight = 12 N; support force = 12 N upward**