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SPECA

GCSE Combined Science (AQA Trilogy) · Physics

Forces: Interactions, Work Done and Elasticity, Mark Scheme

For use with the Tiered Worksheet. Marking points are indicative, not exhaustive: award equivalent correct answers.

Section A: Foundation (Q1 to 16)

1) Scalar: magnitude only, e.g. speed/distance/mass (1); vector: magnitude and direction, e.g. force/velocity/weight (1) [2]

2) Force: a push or pull arising from an object's interaction with another object (1); any two contact forces, e.g. friction, air resistance, tension, normal contact force (1); any two non-contact forces, e.g. gravitational, electrostatic, magnetic (1) [3]

3) The skydiver and the air (particles) (1) [1]

4) $W = m \times g = 15 \times 10 = 150$ N (1); correct unit N (1) [2]

5) $W = m \times g = 80 \times 1.6 = 128$ N (1); correct unit N (1) [2]

6) Because all of an object's weight can be considered to act from one representative point, for the purposes of calculation (1); centre of mass [1]

7) Resultant = $30 - 12 = 18$ N (1); to the right (1) [2]

8) $W = F \times s = 200 \times 5 = 1000$ J (1); correct unit J (1) [2]

9) $W = F \times s$ (1); 1 joule = 1 newton-metre (1) [2]

10) Some of the work done is transferred to the particles at the surfaces in contact, increasing their kinetic energy (heating them) rather than all being transferred usefully (1) [1]

11) Elastic deformation: the object returns to its original shape once the force is removed (1); inelastic deformation: the object does not return to its original shape (1) [2]

12) A single force would simply move the whole object, rather than changing its shape (1) [1]

13) $F = k \times e = 40 \times 0.15 = 6$ N (1); correct unit N (1) [2]

14) $k = F \div e = 6 \div 0.03 = 200$ N/m (1); correct unit N/m (1) [2]

15) $E_e = ½ \times k \times e^2$ (1); $= ½ \times 25 \times 0.2^2 = ½ \times 25 \times 0.04$ (1); $= 0.5$ J (1) [3]

16) The work done is equal to the elastic potential energy stored in the spring (1) [1]

Section B: Higher (Q17 to 19)

17) Forces listed: weight 20 N down, normal contact force 20 N up, applied force 8 N right, friction 8 N left (1 mark for a correctly listed free body diagram); vertical forces balance (20 N up = 20 N down) and horizontal forces balance (8 N right = 8 N left) (1); resultant force = 0 N (1) [3]

18) Horizontal component = $100 \times \cos(30°) \approx 87$ N (1); vertical component = $100 \times \sin(30°) = 50$ N (1); a sensible, clearly stated scale used consistently in the diagram, e.g. 1 cm = 10 N (1) [3]

19) Equilibrium means the resultant force on an object is zero: all the forces balance (1); in a vector diagram, the force arrows are drawn tip-to-tail (or as a closed polygon); if they form a closed shape with no gap, the forces are in equilibrium (1) [2]

Total: 29 marks (Section A) + 8 marks (Section B) = 37 marks

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