3.2 Further Mechanics: Work, Energy and Power: 10-minute Pack

AQA 7367 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Formulae and modelling assumptions used in this worksheet

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Unless a question states otherwise, take g = 9.8 m s^-2 and model each object as a particle. Strings and ropes are light and inextensible, and any pulleys or engines are treated as smooth or ideal unless stated. Key results used across this worksheet: work done by a constant force F acting through a displacement s at angle theta to the direction of motion is W = F*s*cos(theta); kinetic energy is KE = (1/2)*m*v^2; gravitational potential energy relative to a reference level is GPE = m*g*h; the work-energy principle states that the total work done by all the forces acting on a particle equals the change in its kinetic energy; power is the rate of doing work, so for a force F moving its point of application at speed v in the direction of F, P = F*v, and the work done over a time interval is W = integral of P with respect to t; for a force that varies with displacement, F(x), the work done as the point of application moves from x = a to x = b is W = integral from a to b of F(x) dx.

1 This question concerns the work-energy principle for a particle moving under a system of forces.

(a) State the work-energy principle. **(1)**

(b) A particle of mass 2 kg is initially moving at 3 m/s. A resultant force acting on the particle does 60 J of work on it as it moves. Find the final speed of the particle. **(3)**

(Total for Question 1 is 4 marks)

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2 A resultant force of constant magnitude 30 N acts on a body of mass 5 kg, in the direction of its motion, while the body is initially moving at 2 m/s. The force continues to act as the body moves a further distance of 10 m in a straight line.

(a) Find the speed of the body after it has moved the 10 m distance. **(4)**

(Total for Question 2 is 4 marks)

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Mark scheme · 3.2 Further Mechanics: Work, Energy and Power: 10-minute Pack

Question 1

(a) the total work done by the resultant of all the forces acting on a particle equals the change in its kinetic energy, oe **B1**

(a) Answer: The total work done by the resultant force acting on a particle equals the change in its kinetic energy.

(b) final KE = initial KE + work done = $(1/2)*2*3^2 + 60$ **M1**

(b) rearranges to $v^2 = 2*(\text{final KE})/2$, i.e. $v^2 = \text{final KE}$ **M1**

(b) v = 8.31 m/s, awrt, cao **A1**

(b) Answer: v = awrt 8.31 m/s

Question 2

(a) work done by resultant force = F*s = 30*10 = 300 (J) **M1**

(a) applies the work-energy principle: $(1/2)*5*v^2 - (1/2)*5*2^2 = 300$ **M1**

(a) $v^2 = 124$, oe **A1**

(a) v = 11.1 m/s, awrt, cao **A1**

(a) Answer: v = awrt 11.1 m/s

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