3.10 Physics Equations: Recall, Rearrangement and Application: 30-minute Pack

AQA 8464 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 More equations from the memorise list, this time on power and electricity.

(a) Write down the equation that links power to energy transferred and time taken. **(1)**

.....

(b) Write down the equation that links potential difference, current and resistance. **(1)**

.....

(c) Write down the equation for electrical power in terms of potential difference and current. **(1)**

.....

(d) Write down the equation that links charge flow to current and time. **(1)**

.....

(e) Write down the equation for energy transferred in terms of charge flow and potential difference. **(1)**

.....

(Total for Question 1 is 5 marks)

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SECTION 2: REARRANGEMENT. Each equation below is given. Rearrange it to make the stated quantity the subject.

2 **(a)** F = ma. Make a the subject. **(1)**

(b) v = f λ. Make f the subject. **(1)**

(c) s = vt. Make t the subject. **(1)**

(Total for Question 2 is 3 marks)

3 Priya pushes a supermarket trolley with a steady force of 40 N through a distance of 12 m across the car park. Using W = Fs, calculate the work done on the trolley.

(Total for Question 3 is 2 marks)

4 Mei cycles to college. She and her bicycle have a combined mass of 72 kg and are travelling at a velocity of 6.0 m/s. Using p = mv, calculate their momentum.

(Total for Question 4 is 2 marks)

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5 A rock sample collected on a geography field trip has a mass of 158 g and a volume of 62 cm^3.

(a) Using $\rho = m/V$, calculate the density of the rock in g/cm^3. Give your answer to 3 significant figures. **(2)**

.....

(b) Convert this density to kg/m^3, using the fact that 1 g/cm^3 = 1000 kg/m^3. **(2)**

(Total for Question 5 is 4 marks)

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6 A car of mass 1200 kg travels at a constant speed of 15 m/s.

(a) Using KE = 0.5 m v^2, calculate the kinetic energy of the car. **(3)**

(b) The car's speed increases to 30 m/s (double its original speed), with its mass unchanged. State the factor by which the car's kinetic energy increases, and explain your answer using the kinetic energy equation. **(3)**

(Total for Question 6 is 6 marks)

7 A builder's electric hoist lifts a bucket of cement of mass 25 kg through a vertical height of 8.0 m.

(a) Using GPE = mgh, with gravitational field strength g = 9.8 N/kg, calculate the gravitational potential energy gained by the bucket. **(2)**

(b) The hoist takes 5.0 s to lift the bucket to this height. Using your answer to part (a) and P = E/t, calculate the power output of the hoist's motor. **(2)**

(Total for Question 7 is 4 marks)

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Mark scheme · 3.10 Physics Equations: Recall, Rearrangement and Application: 30-minute Pack

Question 1

(a) power = energy transferred / time taken (P = E/t), oe **B1**

(a) Answer: power = energy transferred / time taken (P = E/t)

(b) potential difference = current x resistance (V = IR), oe **B1**

(b) Answer: potential difference = current x resistance (V = IR)

(c) power = potential difference x current (P = VI), oe **B1**

(c) Answer: power = potential difference x current (P = VI)

(d) charge flow = current x time (Q = It), oe **B1**

(d) Answer: charge flow = current x time (Q = It)

(e) energy transferred = charge flow x potential difference (E = QV), oe **B1**

(e) Answer: energy transferred = charge flow x potential difference (E = QV)

Question 2

(a) a = F/m, oe (accept a = F divided by m) **B1**

(a) Answer: a = F/m

(b) f = v/λ, oe **B1**

(b) Answer: f = v/λ

(c) t = s/v, oe **B1**

(c) Answer: t = s/v

Question 3

correct substitution: W = 40 x 12 **M1**

W = 480 J, cao **A1**

Answer: 480 J

Question 4

correct substitution: p = 72 x 6.0 **M1**

p = 432 kg m/s, cao **A1**

Answer: 432 kg m/s

Question 5

(a) correct substitution: ρ = 158/62 **M1**

(a) ρ = 2.55 g/cm^3 (3 sf), awrt 2.55 **A1**

(a) Answer: 2.55 g/cm^3 (3 sf)

(b) correct use of the conversion factor: density in kg/m^3 = density in g/cm^3 x 1000 **M1**

(b) awrt 2550 kg/m^3 (accept 2540-2550 kg/m^3, ft from (a)) **A1**

(b) Answer: approximately 2550 kg/m^3

Question 6

(a) calculates $v^2 = 15^2 = 225$ **M1**

(a) correct substitution: KE = 0.5 x 1200 x 225 **M1**

(a) KE = 135 000 J (135 kJ), cao **A1**

(a) Answer: 135 000 J (135 kJ)

(b) recognises that kinetic energy is proportional to v^2, not directly proportional to v **B1**

(b) shows the effect of doubling v: $(2v)^2 = 4v^2$, oe **B1**

(b) states that the kinetic energy increases by a factor of 4 (it quadruples) **B1**

(b) Answer: The kinetic energy increases by a factor of 4 (it quadruples).

Question 7

(a) correct substitution: GPE = 25 x 9.8 x 8.0 **M1**

(a) GPE = 1960 J, cao **A1**

(a) Answer: 1960 J

(b) correct substitution using the GPE found in (a), ft: P = 1960 / 5.0 **M1**

(b) P = 392 W, cao (ft from (a)) **A1**

(b) Answer: 392 W

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