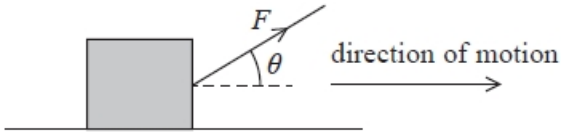
Work, Energy and Power (MCQ Only)

Q1.

A rope is used to apply a force *F* to a box as shown. The box is pulled a distance *d* along a horizontal surface.



Which of the following could be used to determine the work done on the box?

☒ **A** $Fd \sin\theta$

☒ **B** $\frac{Fd}{\sin\theta}$

☒ **C** $Fd \cos\theta$

☒ **D** $\frac{Fd}{\cos\theta}$

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A power station provides electrical power at a mean rate of 3500 MW.

Which of the following gives the best estimate of the energy provided to consumers over a period of a year?

1 year = 3.2×10^7s

☒ **A** 1×10^6 J

☒ **B** 1×10^{11} J

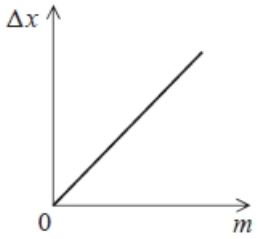
☒ **C** 1×10^{13} J

☒ **D** 1×10^{17} J

(Total for question = 1 mark)

Q3.

A spring is hung vertically and masses are added to the lower end.
The graph shows how the extension Δx of the spring varies with the mass m added.



The work done in extending the spring can be expressed as

(1)

☒ **A** $mg\Delta x$

☒ **B** $\frac{mg}{\Delta x}$

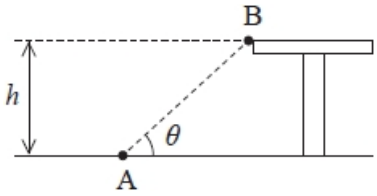
☒ **C** $\frac{1}{2}mg\Delta x$

☒ **D** $\frac{mg}{2\Delta x}$

(Total for question = 1 mark)

Q4.

An object of mass m is moved from point A on the ground, to point B on a bench of height h as shown in the diagram.



Which of the following is a correct expression for the work done on the object?

(1)

☒ **A** $\frac{mgh}{\sin\theta}$

☒ **B** $\frac{mgh}{\cos\theta}$

☒ **C** mgh

☒ **D** $mgh\sin\theta$

(Total for question = 1 mark)

Q5.

An object of weight 7 N is raised from a height of 2 m to a height of 8 m.
The change in gravitational potential energy is

- ☒ **A** 42 J
- ☒ **B** 56 J
- ☒ **C** 412 J
- ☒ **D** 549 J

(Total for question = 1 marks)

Q6.

A car of mass 1.5×10^3 kg is travelling at a speed of 25 m s^{-1}. The driver applies the brakes and the car comes to rest.

Which of the following gives the decrease in kinetic energy, in joules, as the car is brought to rest?

- ☒ **A** $750 \times (25)^2$
- ☒ **B** $750 \times \left(\frac{25}{2}\right)^2$
- ☒ **C** $1500 \times (25)^2$
- ☒ **D** $1500 \times \left(\frac{25}{2}\right)^2$

(Total for question = 1 mark)

Q7.

A cyclist travels up a slope through a vertical height *h* in a time *t*. The mass of the cyclist and his bike is *m*.

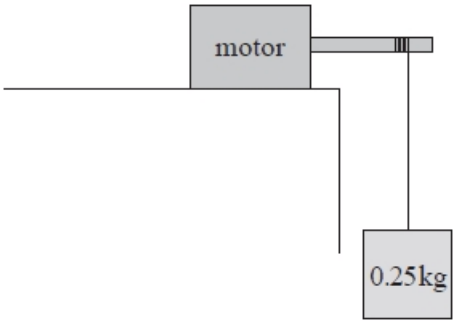
The average power of the cyclist is

- ☒ **A** $\frac{mg}{t}$
- ☒ **B** $\frac{t}{mg}$
- ☒ **C** $\frac{mgh}{t}$
- ☒ **D** $\frac{t}{mgh}$

(Total for question = 1 mark)

Q8.

A motor is used to lift an object as shown. The object is raised through a vertical height of 75 cm at a constant speed of 0.40 m s^{-1}.



Which of the following gives the rate of increase of potential energy of the object in watts?

☒ **A** 0.25 × 9.81 × 0.40

☒ **B** 0.25 × 0.75

☒ **C** 0.25 × 9.81 × 0.75

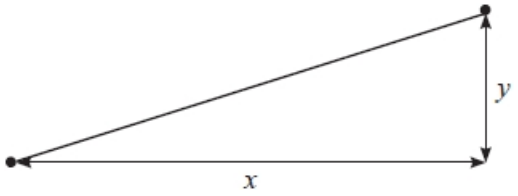
☒ **D** 0.5 × 0.25 × $(0.40)^2$

(Total for question = 1 mark)

Q9.

An object of mass *m* is moved from the bottom to the top of a slope. The vertical height of the slope is *y*.

The horizontal distance between the bottom and top of the slope is *x*.



Which of the following gives the gain of gravitational potential energy of the object as it moves from the bottom to the top of the slope?

☒ **A** mgx

☒ **B** mgy

☒ **C** $mg(x + y)$

☒ **D** $mg\sqrt{(x^2 + y^2)}$

(Total for question = 1 mark)

Q10.

A car of mass 1.2×10^3 kg is travelling at a speed of 18 m s^{-1}. The driver applies the brakes and the car comes to rest.

What is the work done by the brakes in stopping the car?

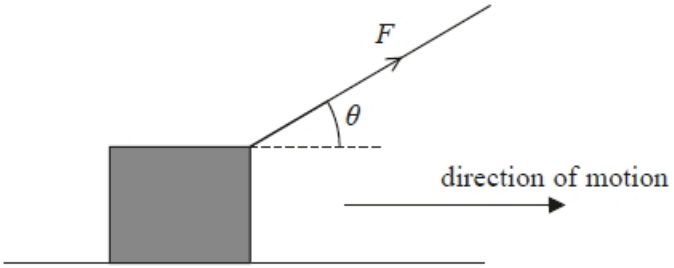
- ☒ **A** 11 kJ
- ☒ **B** 22 kJ
- ☒ **C** 190 kJ
- ☒ **D** 390 kJ

(Total for question = 1 mark)

Q11.

A rope is used to pull a box a distance *d* along a horizontal surface at a constant speed.

A force *F* is applied to the rope and the rope is at an angle *θ* to the horizontal.



Which of the following could be used to determine the work done on the box?

- ☒ **A** $\frac{Fd}{\cos\theta}$
- ☒ **B** $Fd\cos\theta$
- ☒ **C** $\frac{Fd}{\sin\theta}$
- ☒ **D** $Fd\sin\theta$

(Total for question = 1 mark)

Q12.

The velocity v of a non-relativistic particle can be expressed in terms of combinations of the following quantities: kinetic energy E_k, momentum p and mass m.

Which of the following expressions is correct?

☒ **A** $v = \frac{p^2}{m}$

☒ **B** $v = \sqrt{\frac{2E_k}{m}}$

☒ **C** $v = \frac{E_k}{2p}$

☒ **D** $v = \frac{2E_k}{pm}$

(Total for question = 1 mark)

Mark Scheme – Work, Energy and Power (MCQ Only)

Q1.

Question Number	Answer	Additional Guidance	Mark
	C is the only correct answer	A is incorrect because the wrong trigonometric function has been used B is incorrect because the wrong trigonometric function has been used D is incorrect because the wrong algebraic equation has been used	**1**

Q2.

Question Number	Answer	Mark
	D 1×10^{17} J	**1**
	A – this answer is incorrect B – this answer is incorrect C – this answer is incorrect	

Q3.

Question Number	Answer	Mark
	C $\frac{1}{2}mg\Delta x$	**1**
	Incorrect Answers: A – no factor of $\frac{1}{2}$ B – incorrect equation and no factor of $\frac{1}{2}$ D – incorrect equation	

Q4.

Question Number	Acceptable answers	Additional guidance	Mark
	C	*mgh*	**1**
	A uses the distance AB rather than height B uses a component of height D uses a component of height		

Q5.

Question Number	Answer	Mark
	A	1

Q6.

Question Number	Answer	Additional Guidance	Mark
	A is the only correct answer	B is incorrect because speed has been divided by 2 C is incorrect because $E_K = 0.5\ mv^2$ D is incorrect because $E_K = 0.5\ mv^2$	**1**

Q7.

Question Number	Acceptable Answer	Additional guidance	Mark
	C	$\frac{mgh}{t}$	**(1)**

Q8.

Question Number	Answer	Additional Guidance	Mark
	A is the only correct answer	B is incorrect because $P = mgh/t = mgv$ C is incorrect because $P = mgh/t = mgv$ D is incorrect because $P = mgh/t = mgv$	**1**

Q9.

Question Number	Answer	Mark
	B - mgy, $E_P = mg\Delta h$, correct distance (vertical)	1
	Incorrect Answers: **A** – incorrect distance (horizontal) **C** – incorrect distance (horizontal + vertical) **D** – incorrect distance (length of slope)	

Q10.

Question Number	Answer	Mark
	C 190 kJ	1
	Incorrect Answers: A – The velocity was not squared when using the formula $E_k = ½ mv^2$ e.g. $½ (1.2 \times 10^3)(18) = 11$ kJ B – The velocity was not squared and the ½ was omitted when using the formula $E_k = ½ mv^2$ e.g. $(1.2 \times 10^3)(18) = 22$ kJ D – The ½ was omitted when using the formula $E_k = ½ mv^2$ e.g. $(1.2 \times 10^3)(18)^2 = 390$ kJ	

Q11.

Question Number	Acceptable answers	Additional guidance	Mark
	B		1

Q12.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is B *A is not correct because this is not dimensionally correct* *C is not correct because* $E_k/_{2p} = v/_4$ *D is not correct because this is not dimensionally correct*		1