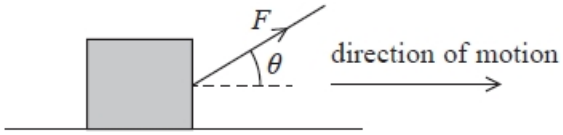
# Work, Energy and Power (MCQ Only)

**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 = $3.2 \times 10^7$s

☒ **A** $1 \times 10^6$ J

☒ **B** $1 \times 10^{11}$ J

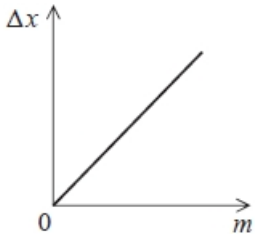
☒ **C** $1 \times 10^{13}$ J

☒ **D** $1 \times 10^{17}$ 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 $\Delta x$ 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** $\frac{mg}{\Delta x}$

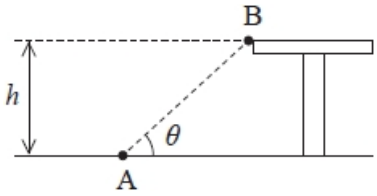
☒ **C** $\frac{1}{2}mg\Delta x$

☒ **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 $1.5 \times 10^3$ 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*.

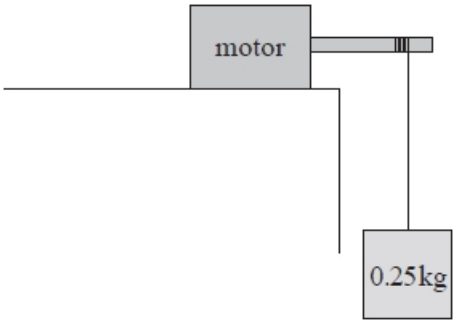
The average power of the cyclist is

- ☒ **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

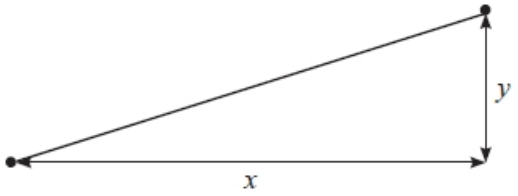
☒ **D** 0.5 × 0.25 × $(0.40)^2$

**(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 $1.2 \times 10^3$ 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?

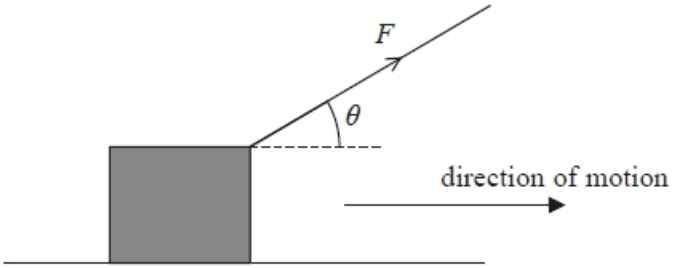
- ☒ **A** 11 kJ
- ☒ **B** 22 kJ
- ☒ **C** 190 kJ
- ☒ **D** 390 kJ

**(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<br>B is incorrect because the wrong trigonometric function has been used<br>D is incorrect because the wrong algebraic equation has been used | **1** |

**Q2.**

| Question Number | Answer | Mark |
|---|---|---|
| | **D $1 \times 10^{17}$ J** | **1** |
| | A – this answer is incorrect<br>B – this answer is incorrect<br>C – this answer is incorrect | |

**Q3.**

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

**Q4.**

| Question Number | Acceptable answers | Additional guidance | Mark |
|---|---|---|---|
| | C | *mgh* | **1** |
| | A uses the distance AB rather than height<br>B uses a component of height<br>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<br>C is incorrect because $E_K = 0.5\ mv^2$<br>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 $P = mgh/t = mgv$<br>C is incorrect because $P = mgh/t = mgv$<br>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:<br>**A** – incorrect distance (horizontal)<br>**C** – incorrect distance (horizontal + vertical)<br>**D** – incorrect distance (length of slope) | |

**Q10.**

| Question Number | Answer | Mark |
|---|---|---|
| | C 190 kJ | 1 |
| | Incorrect Answers:<br>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<br>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<br>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**<br>*A is not correct because this is not dimensionally correct*<br>*C is not correct because* $E_k/_{2p} = v/_4$<br>*D is not correct because this is not dimensionally correct* | | 1 |