FREE REVISION PACK

Slopes

A-level Physics · Theme pack · questions from AQA, OxfordAQA, Edexcel, Edexcel IAL, OCR A and OCR B

Easy | Medium | Hard | Multiple choice · past-paper questions

29	29	≈ 45 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Reading a velocity–time graph	OCR A June 2022 · A-level Modelling physics · Q3	1 mark
2	Easy	Which force does no work	OCR A June 2017 · AS Breadth in physics · Q17	1 mark
3	Easy	Newton's third law pairs on a ramp	Edexcel IAL October 2020 · Unit 1 · Q2	1 mark
4	Easy	GPE gained going up a slope	Edexcel October 2020 · AS Paper 1 · Q2	1 mark
5	Easy	Why the speed is constant	Edexcel IAL October 2024 · Unit 1 · Q5	1 mark
6	Easy	Friction at constant speed	Edexcel IAL June 2025 · Unit 1 · Q8	1 mark
7	Easy	Friction on a stationary block	OxfordAQA January 2026 · Unit 1 · Q21	1 mark
8	Easy	Matching graphs to motion on ramps	Edexcel June 2016 · AS Paper 1 · Q6	1 mark
9	Easy	Efficiency of a motor on a slope	Edexcel June 2023 · AS Paper 1 · Q6	1 mark
10	Easy	Components of velocity on an incline	Edexcel IAL October 2019 · Unit 1 · Q5	1 mark
11	Easy	Component of weight into the slope	OCR B October 2021 · A-level Fundamentals of physics · Q10	1 mark
12	Easy	Work done by gravity down a hill	OCR B October 2020 · AS Foundations of physics · Q10	1 mark
13	Easy	Acceleration along a slope with an angled force	AQA June 2024 · A-level Paper 1 · Q18	1 mark
14	Medium	Effect of doubling the mass	AQA June 2023 · A-level Paper 1 · Q24	1 mark
15	Medium	Triangle of forces for a block at rest	OCR A June 2016 · AS Breadth in physics · Q7	1 mark
16	Medium	Triangle of forces with the slope angle	OCR A October 2020 · A-level Modelling physics · Q8	1 mark
17	Medium	Work done along a slope	Edexcel IAL June 2022 · Unit 1 · Q9	1 mark
18	Medium	Efficiency of a ramp	Edexcel IAL January 2019 · Unit 1 · Q4	1 mark
19	Medium	Work done against resistive forces	Edexcel June 2024 · A-level Paper 1 · Q3	1 mark
20	Medium	Speed at the bottom of a frictionless slope	Edexcel IAL June 2023 · Unit 1 · Q8	1 mark
21	Medium	Finding the slope angle	AQA June 2025 · A-level Paper 1 · Q23	1 mark
22	Medium	Work done up a slope with friction	OCR B June 2023 · A-level Fundamentals of physics · Q16	1 mark
23	Medium	Average resistive force from an energy loss	OCR A June 2017 · AS Breadth in physics · Q13	1 mark
24	Medium	Frictional force from energy	OxfordAQA January 2024 · Unit 1 · Q19	1 mark
25	Medium	Speed from power on a hill	AQA June 2018 · AS Paper 2 · Q21	1 mark
26	Medium	Extra power needed up a hill	AQA June 2025 · AS Paper 2 · Q34	1 mark
27	Hard	Power output on and off a hill	Edexcel IAL January 2024 · Unit 1 · Q4	1 mark
28	Hard	Average friction from an energy loss	AQA June 2017 · AS Paper 2 · Q5	1 mark
29	Hard	Resistive force from power on a slope	OxfordAQA June 2024 · Unit 1 · Q21	1 mark

Key ideas to have ready

- Resolve the weight: **mg sin θ** down the slope, **mg cos θ** into it. Constant speed (or at rest) means the forces along the slope balance.
- Work and energy: gain in GPE = mgh with h the **vertical** height; distance along the slope = h / sin θ. Work against friction = loss of (GPE + KE).
- Power = force × velocity. Going up a hill at constant speed, the engine must also supply mg sin θ × v.

How to use this pack

1. The questions are grouped into levels (Easy, Medium and Hard). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in the exam boards' examiner reports where that information exists, plus our own difficulty rating.
*About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–13

Choose **one** answer for each question. The questions come from different exam boards, so the answer boxes look different: just mark the letter you choose.

OCR A June 2022 · A-level Modelling physics · Q3

1 A student has plotted a velocity against time graph for a trolley moving down a ramp.

Which of the following pair of quantities can be determined from the gradient of the graph and the area under the graph?

A acceleration, displacement

B acceleration, impulse

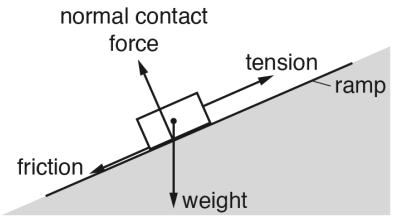
C displacement, kinetic energy

D force, work done

Your answer ☐ **[1]**

OCR A June 2017 · AS Breadth in physics · Q17

2 A block moves at **constant** speed up a ramp.
The diagram below shows all the forces acting on the block.



Which force does no work on, or against, the object as it travels up the ramp?

A weight

B friction

C tension

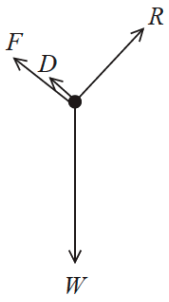
D normal contact force

Your answer ☐ **[1]**

Edexcel IAL October 2020 · Unit 1 · Q2

3 A box was placed at the top of a ramp and released.

The free-body force diagram for the box as it moved down the ramp at a constant velocity is shown.



D = air resistance

F = frictional force

R = normal contact force

W = weight of the box

Which two forces acting on the box have, according to Newton's third law, corresponding forces acting on the ramp?

☒ **A** F and D

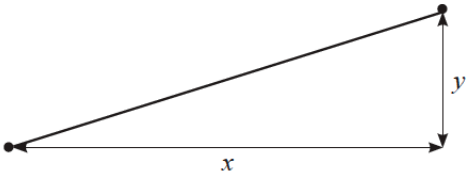
☒ **B** F and R

☒ **C** W and D

☒ **D** W and R

Edexcel October 2020 · AS Paper 1 · Q2

4 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** $mg\sqrt{(x^2 + y^2)}$

Edexcel IAL October 2024 · Unit 1 · Q5

5 A box slides down a slope at a constant speed. Weight and resistive forces both act on the box.

Which of the following is a reason why the speed of the box is constant?

☒ **A** The component of the weight parallel to the slope is equal to the sum of the resistive forces.

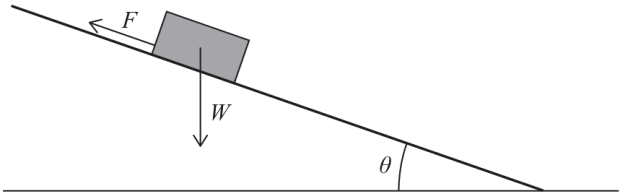
☒ **B** The component of the weight parallel to the slope is greater than the sum of the resistive forces.

☒ **C** The component of the weight perpendicular to the slope is equal to the sum of the resistive forces.

☒ **D** The component of the weight perpendicular to the slope is greater than the sum of the resistive forces.

Edexcel IAL June 2025 · Unit 1 · Q8

6 A box of weight W slides down a ramp. The ramp is at an angle θ to the horizontal.
A frictional force F acts on the box, as shown.



Which of the following is correct when the box moves at a constant speed?

☒ **A** $F = W\cos\theta$

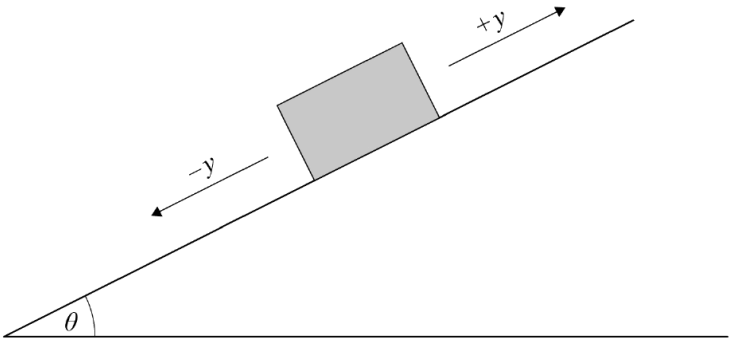
☒ **B** $F < W\cos\theta$

☒ **C** $F = W\sin\theta$

☒ **D** $F < W\sin\theta$

OxfordAQA January 2026 · Unit 1 · Q21

7 A block of mass m is stationary on a slope.



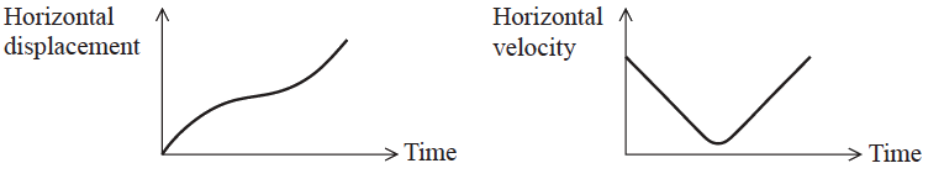
Which row shows the magnitude and direction of the frictional force acting on the block?

[1 mark]

	Magnitude	Direction	
A	$mg \cos \theta$	$+y$	⬭
B	$mg \cos \theta$	$-y$	⬭
C	$mg \sin \theta$	$+y$	⬭
D	$mg \sin \theta$	$-y$	⬭

Edexcel June 2016 · AS Paper 1 · Q6

8 The graphs shown represent the displacement-time and velocity-time graphs for the horizontal component of the motion of a ball.



Which of the following situations could produce this motion of the ball?

☒ **A** Rolling down one ramp and then rolling up a second ramp.

☒ **B** Rolling down a ramp then along the floor.

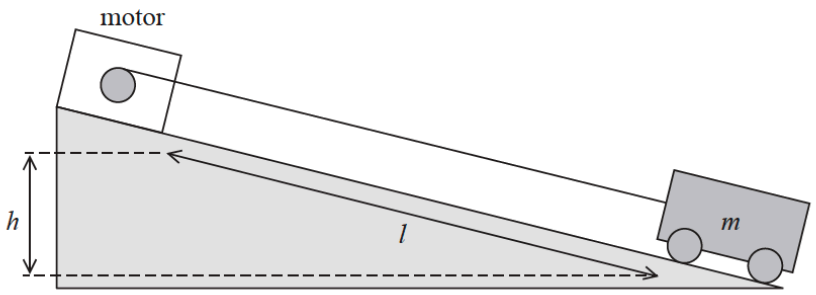
☒ **C** Rolling up one ramp and down a second ramp.

☒ **D** Rolling up a ramp and rolling back down the same ramp.

Edexcel June 2023 · AS Paper 1 · Q6

9 The diagram shows an electric motor pulling a truck of mass m along a slope. The truck moves through a vertical height h and a distance l along the slope, during a time t.

There is a potential difference V across the motor and a current I in the motor.



Which of the following expressions gives the efficiency of the motor?

☒ **A** $\frac{VIt}{mgl}$

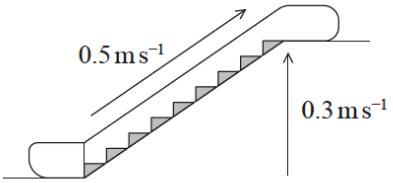
☒ **B** $\frac{VIt}{mgh}$

☒ **C** $\frac{mgl}{VIt}$

☒ **D** $\frac{mgh}{VIt}$

Edexcel IAL October 2019 · Unit 1 · Q5

10 The steps on an escalator move with a speed of $0.5\,\text{m s}^{-1}$. The vertical component of their velocity is $0.3\,\text{m s}^{-1}$ upwards.



Which of the following is the horizontal component of velocity for the escalator steps?

☒ **A** $0.2\,\text{m s}^{-1}$

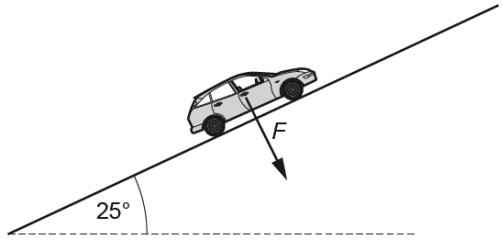
☒ **B** $0.4\,\text{m s}^{-1}$

☒ **C** $0.5\,\text{m s}^{-1}$

☒ **D** $0.8\,\text{m s}^{-1}$

OCR B October 2021 · A-level Fundamentals of physics · Q10

11 A car of mass 1100 kg moves up a hill of gradient 25°.



The force *F* is a component of the weight of the car.
What is the value of *F*, to **2** significant figures?

A 4600 N

B 9800 N

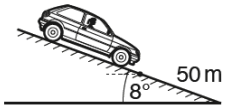
C 12000 N

D 26000 N

Your answer ☐ **[1]**

OCR B October 2020 · AS Foundations of physics · Q10

12 Calculate the work done by gravity when the car shown below, of mass 500 kg, rolls 50 m down a hill which slopes at an angle of 8 degrees.



A 3 kJ

B 34 kJ

C 243 kJ

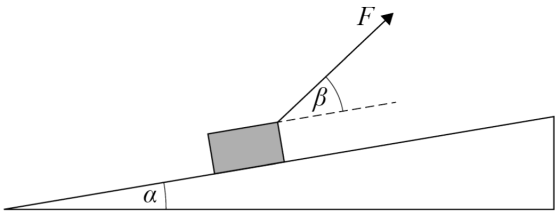
D 250 kJ

Your answer ☐

[1]

AQA June 2024 · A-level Paper 1 · Q18

13 A force of magnitude F acts on a box of mass m that moves along a frictionless slope.
The slope is at an angle α to the horizontal and the force acts at an angle β to the slope.



What is the magnitude of the acceleration of the block along the slope?

[1 mark]

A $\frac{F}{m}\sin\alpha - g\sin\beta$ ⬭

B $\frac{F}{m}\cos\beta - g\sin\alpha$ ⬭

C $\frac{F}{m}\cos(\alpha+\beta) - g\cos\beta$ ⬭

D $\frac{F}{m}\cos(\alpha+\beta) - g\sin\beta$ ⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 14–26

AQA June 2023 · A-level Paper 1 · Q24

14 A trolley moves down a slope with constant acceleration.
The mass of the trolley is doubled and the trolley moves down the same slope again.
Air resistance and friction are negligible.

Which is correct?

[1 mark]

A The accelerating force is unchanged. ⬭

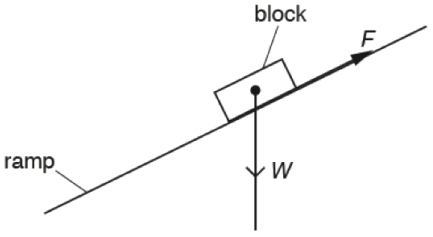
B The accelerating force is halved. ⬭

C The acceleration is unchanged. ⬭

D The acceleration is halved. ⬭

OCR A June 2016 · AS Breadth in physics · Q7

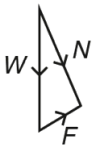
15 A block of wood is at rest on a ramp.
The weight of the block is *W* and the frictional force on the block is *F*.



A triangle of forces diagram can be used to determine the magnitude and the direction of the normal contact force *N*.

Which is the correct diagram for this triangle?

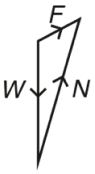
A



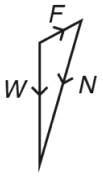
B



C

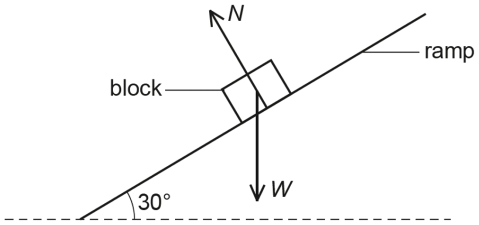


D



OCR A October 2020 · A-level Modelling physics · Q8

16 A wooden block is **stationary** on a ramp.

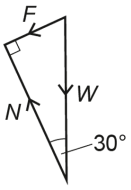


The diagram is **not** drawn to scale.

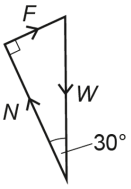
The block has weight *W*. The normal contact force on the block is *N*. The frictional force *F* on the block is not shown on the diagram.

Which triangle of forces diagram is correct?

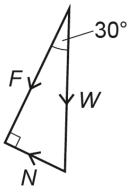
A



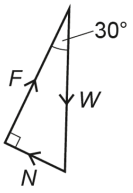
B



C



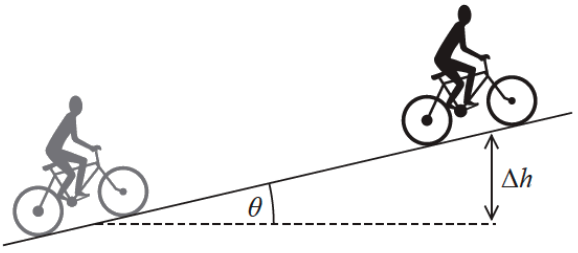
D



Your answer

Edexcel IAL June 2022 · Unit 1 · Q9

17 A cyclist rode along a slope at a constant speed. The increase in vertical height of the cyclist was Δh. The slope was at an angle θ to the horizontal as shown.



The forward force of the road on the bicycle was F and air resistance was negligible.

Which of the following gives the work done by the cyclist?

☒ **A** $F\,\Delta h\cos\theta$

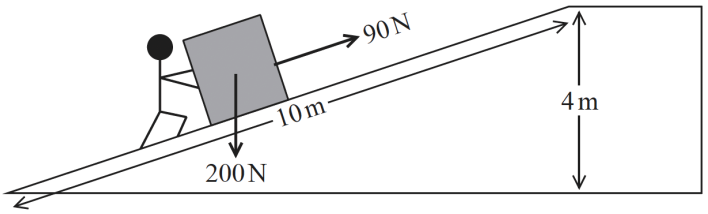
☒ **B** $\dfrac{F\,\Delta h}{\cos\theta}$

☒ **C** $F\,\Delta h\sin\theta$

☒ **D** $\dfrac{F\,\Delta h}{\sin\theta}$

Edexcel IAL January 2019 · Unit 1 · Q4

18 A force of 90 N is used to push a box along a ramp of length 10 m, up to a platform. The platform is 4 m above the ground. The weight of the box is 200 N.



Which of the following expressions could be used to determine the efficiency of the ramp?

☐ **A** $\frac{90 \times 10}{200 \times 4}$

☐ **B** $\frac{200 \times 4}{(90 \times 10) + (200 \times 4)}$

☐ **C** $\frac{200 \times 4}{90 \times 10}$

☐ **D** $\frac{90 \times 10}{(90 \times 10) + (200 \times 4)}$

Edexcel June 2024 · A-level Paper 1 · Q3

19 A toy car moves up a slope at a constant speed, as shown. The car is moved by a motor with a power output of 5.2 W. The car gains a gravitational potential energy of 0.40 J in a time of 1.1 s.



Which of the following expressions gives the work done, in J, against resistive forces?

☐ **A** $5.2 - (0.40 \times 1.1)$

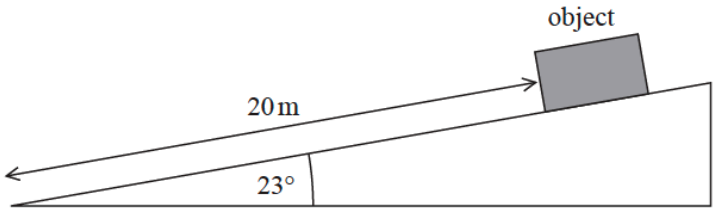
☐ **B** $(5.2 \times 1.1) - 0.40$

☐ **C** $(5.2 \div 1.1) + 0.40$

☐ **D** $(5.2 \times 1.1) + 0.40$

Edexcel IAL June 2023 · Unit 1 · Q8

20 An object accelerates from rest down a frictionless slope. The object moves a distance of 20 m. The slope is at an angle of 23° to the horizontal, as shown.

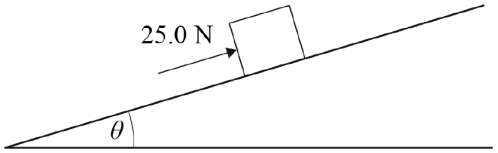


Which of the following gives the final speed of the object in $\mathrm{m\,s^{-1}}$?

- ☒ **A** $\sqrt{2 \times 9.81 \times 20 \times \cos 23°}$
- ☒ **B** $\sqrt{0.5 \times 9.81 \times 20 \times \cos 23°}$
- ☒ **C** $\sqrt{2 \times 9.81 \times 20 \times \sin 23°}$
- ☒ **D** $\sqrt{0.5 \times 9.81 \times 20 \times \sin 23°}$

AQA June 2025 · A-level Paper 1 · Q23

21 A ramp is inclined at an angle θ to the horizontal.
A block of weight 240 N is pushed up the ramp by a 25.0 N force. This force acts parallel to the ramp.
The block experiences a frictional force of 3.0 N.
The block moves at a constant speed.



What is θ?

[1 mark]

A 0.12° ⬭

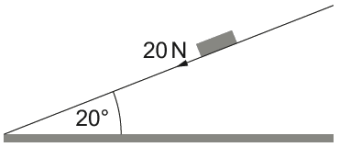
B 5.3° ⬭

C 6.0° ⬭

D 6.7° ⬭

OCR B June 2023 · A-level Fundamentals of physics · Q16

22 A 2.0 kg mass is pulled up a slope of length 9.0 m at constant speed. The slope is at an angle of 20° to the horizontal. A constant frictional force of 20 N acts down the slope.



How much work is done pulling the mass up the full length of the slope?

A 180 J

B 240 J

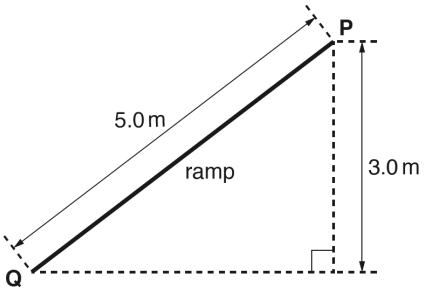
C 346 J

D 974 J

Your answer ☐ **[1]**

OCR A June 2017 · AS Breadth in physics · Q13

23 An object is at the top of a ramp at point **P**. The gravitational potential energy of the object at **P** is 100 J. The object is released from rest at **P**. It travels down the ramp. The kinetic energy of the object at the bottom of the ramp at point **Q** is 60 J.



What is the average resistive force acting on the object as it travels down the ramp?

A 8.0 N

B 10 N

C 12 N

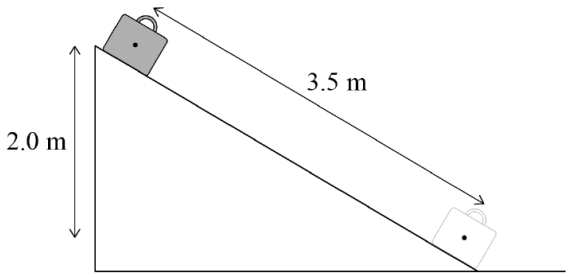
D 20 N

Your answer ☐ **[1]**

OxfordAQA January 2024 · Unit 1 · Q19

24 A suitcase of mass 12 kg slides from rest 3.5 m down a ramp through a vertical height of 2.0 m.

The final speed of the suitcase is 1.5 m s^{-1}.



What is the average frictional force between the ramp and the suitcase?

[1 mark]

A 220 N ⬭

B 67 N ⬭

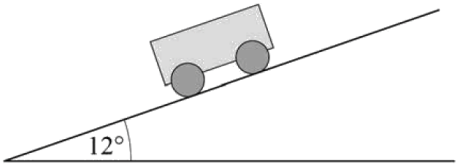
C 63 N ⬭

D 14 N ⬭

AQA June 2018 · AS Paper 2 · Q21

25 A car's engine produces a useful output power of 6.5×10^4 W

The car of mass 950 kg is moving up a hill at a steady speed.
The slope of the hill is 12° to the horizontal. Resistive forces on the car are negligible.



What is the steady speed of the car?

[1 mark]

A 7.0 m s^{-1} ⬭

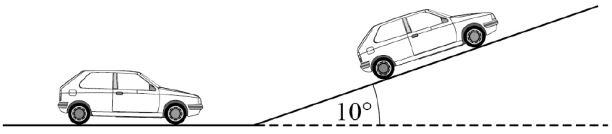
B 12 m s^{-1} ⬭

C 34 m s^{-1} ⬭

D 68 m s^{-1} ⬭

AQA June 2025 · AS Paper 2 · Q34

26 A car moves along a horizontal road at a constant speed of $15\ \text{m s}^{-1}$.
The car's engine provides a constant thrust of $3800\ \text{N}$.
The car then travels up a hill. The slope of the hill is $10°$ to the horizontal.
The power of the car's engine increases so that the car continues at a constant speed of $15\ \text{m s}^{-1}$.



The weight of the car is $12\ 000\ \text{N}$.
Assume that resistive forces are constant.

What is the minimum power output of the engine as the car goes up the hill?

[1 mark]

A $31\ \text{kW}$ ⬭

B $57\ \text{kW}$ ⬭

C $88\ \text{kW}$ ⬭

D $230\ \text{kW}$ ⬭

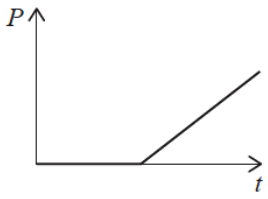
Hard Several steps, often with a trap built in. Fewer than 3 in 10 students get these right. **Questions 27–29**

Edexcel IAL January 2024 · Unit 1 · Q4

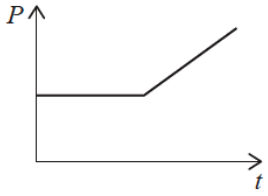
27 A cyclist moves along a horizontal road at a constant speed. She then moves at the same speed up a hill with a constant gradient.

Which of the following graphs shows how the power output P of the cyclist varies with time t?

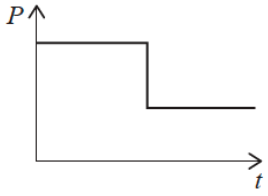
☒ **A**



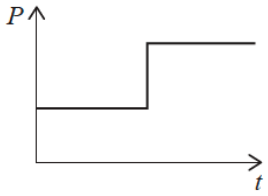
☒ **B**



☒ **C**

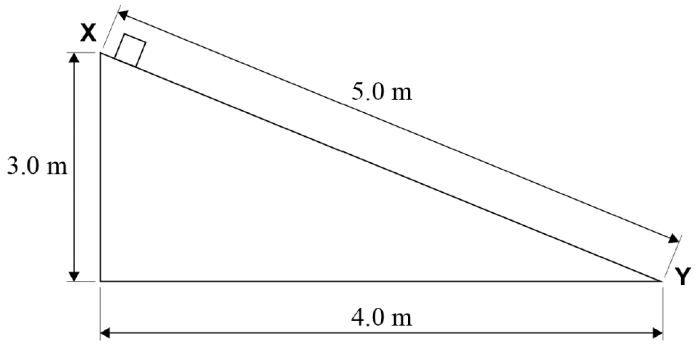


☒ **D**



AQA June 2017 · AS Paper 2 · Q5

28 A mass of $2.5\ \text{kg}$ is released from rest at **X** and slides down a ramp, of height $3.0\ \text{m}$, to point **Y** as shown.



When the mass reaches **Y** at the bottom of the ramp it has a velocity of $5.0\ \text{m s}^{-1}$.

What is the average frictional force between the mass and the ramp?

[1 mark]

A 8.5 N ⬭

B 10.6 N ⬭

C 14.7 N ⬭

D 24.5 N ⬭

OxfordAQA June 2024 · Unit 1 · Q21

29 A car of mass $1200\ \text{kg}$ is travelling up a slope with an incline of $15°$.
The car travels at a constant velocity of $20\ \text{m s}^{-1}$.
The motor provides a constant power output of $150\ \text{kW}$.

What is the magnitude of the resistive forces acting on the car?

[1 mark]

A 3000 N ⬭

B 3900 N ⬭

C 4500 N ⬭

D 11 000 N ⬭

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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