OXFORD

INTERNATIONAL AQA EXAMINATIONS

Topic Test: OxfordAQA International GCSE Physics 9203

Energy

Name: _____

Class: _____

Date: _____

Time: **39 minutes**

Marks: **39 marks**

Comments:

1 When you transfer *energy* to a shopping trolley, the amount of *work done* depends on the *force* used and the *distance moved*.

Complete the table by using the correct units from the box.

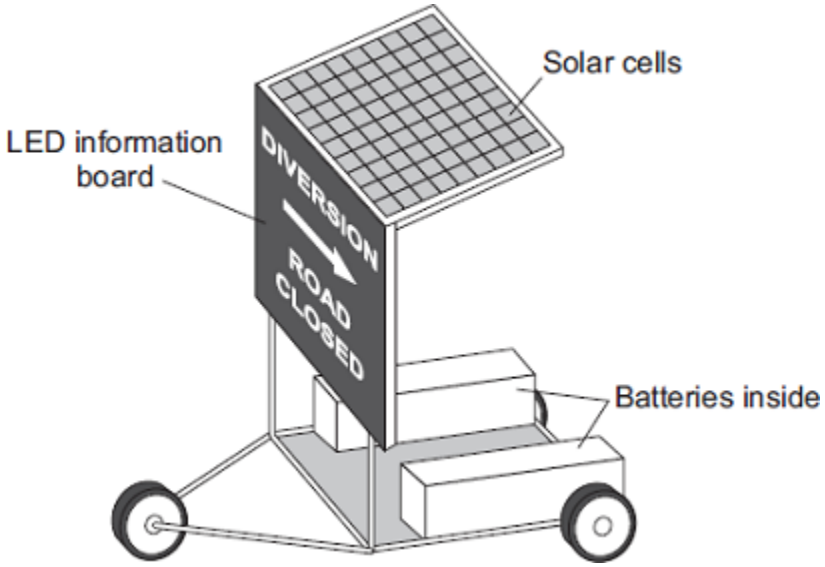
joule (J)	**metre (m)**	**newton (N)**

The first one has been done for you.

Quantity	**Unit**
energy (transferred)	joule
force	
distance (moved)	
work done	

(Total 2 marks)

2 The picture shows a temporary road traffic information board.



The batteries power the LEDs used in the information board.
The solar cells keep the batteries charged.

(a) Use words from the box to complete each of the following sentences.

chemical	**electrical**	**light**	**sound**

The solar cells transfer light energy to _____ energy.

The batteries transfer _____ energy to electrical energy.

The LEDs transfer electrical energy to _____ energy.

(3)

(b) When the total energy input to the solar cells is 200 joules, the useful energy output from the solar cells to the batteries is 50 joules.

Calculate the efficiency of the solar cells.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

Efficiency = _____

(2)

(c) Which **one** of the following statements gives the reason for using solar cells to charge the batteries?

Tick (✓) **one** box.

Solar cells will charge the batteries day and night. ☐

The information board can be used anywhere it is needed. ☐

A small number of solar cells produce a lot of electricity. ☐

(1)

(Total 6 marks)

3 **Table 1** shows information about different light bulbs.

The bulbs all have the same brightness.

Table 1

Type of bulb	Input power in watts	Efficiency
Halogen	40	0.15
Compact fluorescent (CFL)	14	0.42
LED	7	0.85

(a) (i) Calculate the useful power output of the CFL bulb.

Use the correct equation from the Physics Equations Sheet.

_____

_____

_____

Useful power output = _____ watts

(2)

(ii) Use your answer to part **(i)** to calculate the waste energy produced each second by a CFL bulb.

_____

Waste energy per second = _____ joules

(1)

(b) (i) A growth cabinet is used to investigate the effect of light on the rate of growth of plants.

The figure below shows a growth cabinet.

In the cabinet the factors that affect growth can be controlled.

A cooler unit is used to keep the temperature in the cabinet constant. The cooler unit is programmed to operate when the temperature rises above 20 °C.

The growth cabinet is lit using 50 halogen bulbs.

Changing from using halogen bulbs to LED bulbs would reduce the cost of running the growth cabinet.

Explain why.

_____

_____

_____

_____

_____

_____

(4)

(ii) A scientist measured the rate of growth of plants for different intensities of light.

What type of graph should be drawn to present the results?

_____

Give a reason for your answer.

_____

_____

(1)

(c) **Table 2** gives further information about both a halogen bulb and a LED bulb.

Table 2

Type of bulb	Cost to buy	Lifetime in hours	Operating cost over the lifetime of one bulb
Halogen	£1.50	2 000	£16.00
LED	£30.00	48 000	£67.20

A householder needs to replace a broken halogen light bulb.

Compare the cost efficiency of buying and using halogen bulbs rather than a LED bulb over a time span of 48 000 hours of use.

Your comparison must include calculations.

_____

_____

_____

_____

_____

_____

_____

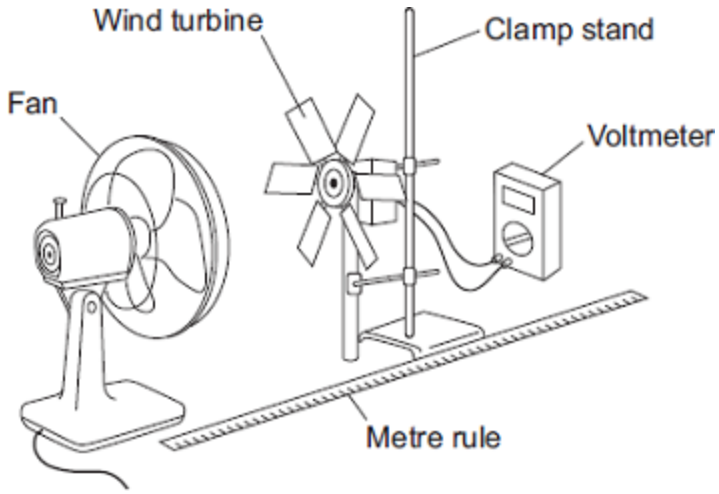
_____

(4)

(Total 12 marks)

4 (a) A student investigated how the number of blades on a wind turbine affects the output voltage of the turbine.

The student used the apparatus shown in the diagram.



The fan was used to turn the wind turbine.

(i) The fan was always the same distance from the wind turbine.

Why?

_____

_____

(1)

(ii) After switching the fan on, the student waited 20 seconds before taking the voltmeter reading.

Suggest why.

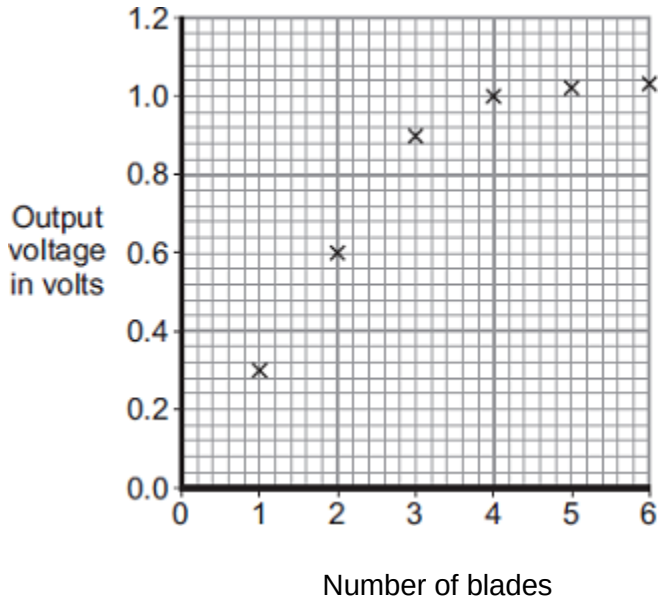
_____

_____

(1)

(iii) The student changed the number of blades on the wind turbine.

The student's results are shown in the scatter graph.



What conclusion can be made from the results in the scatter graph?

_____

_____

_____

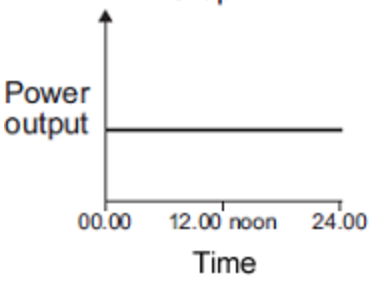
_____

(2)

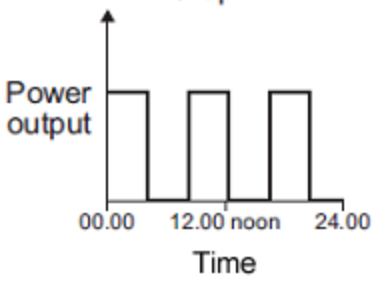
(b) The amount of electricity generated using wind turbines is increasing.

Which graph, **A**, **B** or **C**, is most likely to show the electrical power output from a wind turbine over one day?

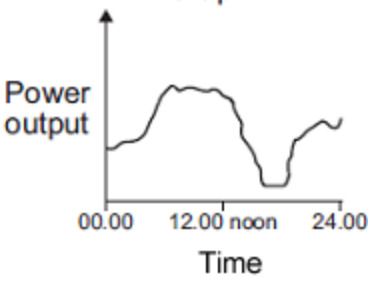
Graph **A**



Graph **B**



Graph **C**



Write the correct answer, **A**, **B** or **C**, in the box. ☐

Give a reason for your answer.

_____

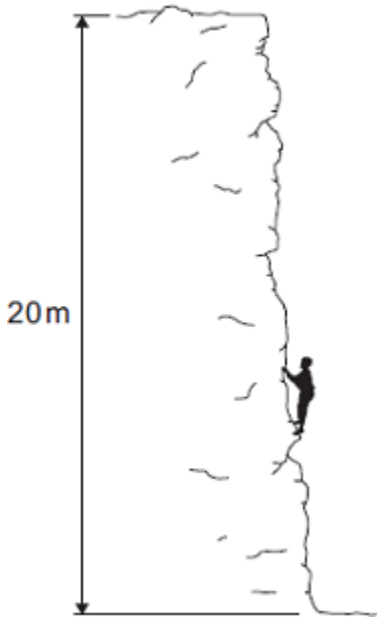
_____

_____

(2)

(Total 6 marks)

5 The diagram shows a climber part way up a cliff.



(a) Complete the sentence.

When the climber moves up the cliff, the climber

gains gravitational _____ energy.

(1)

(b) The climber weighs 660 N.

(i) Calculate the work the climber must do against gravity, to climb to the top of the cliff.

Use the correct equation from the Physics Equations Sheet.

_____

_____

Work done = _____ J

(2)

(ii) It takes the climber 800 seconds to climb to the top of the cliff.
During this time the energy transferred to the climber equals the work done by the climber.

Calculate the power of the climber during the climb.

Use the correct equation from the Physics Equations Sheet.

_____

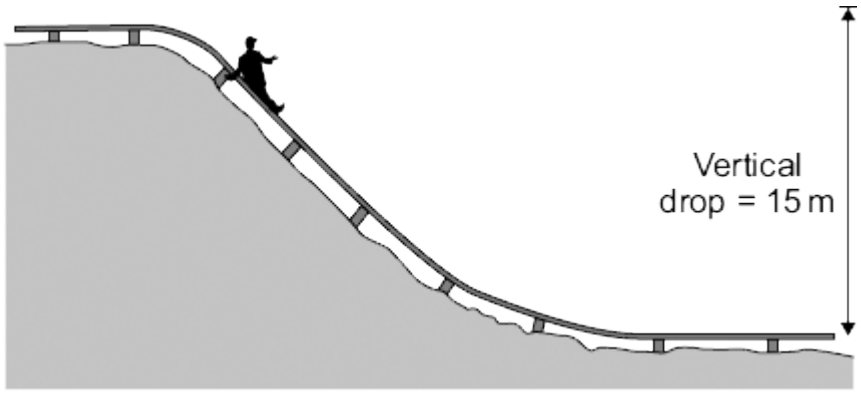
_____

Power = _____ W

(2)

(Total 5 marks)

6 The miners working in a salt mine use smooth wooden slides to move quickly from one level to another.



(a) A miner of mass 90 kg travels down the slide.

Calculate the change in gravitational potential energy of the miner when he moves 15 m vertically downwards.

gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

_____

_____

Change in gravitational potential energy = _____ J

(2)

(b) Calculate the **maximum** possible speed that the miner could reach at the bottom of the slide.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

Give your answer to an appropriate number of significant figures.

Maximum possible speed = _____ m/s

(3)

(c) The speed of the miner at the bottom of the slide is much less than the calculated maximum possible speed.

Explain why.

(3)

(Total 8 marks)

1 newton **or** N

metre **or** m

joules **or** J

all three correct 2 marks
two or one correct 1 mark

[2]

2 (a) electrical

1

chemical

1

light

1

(b) 25% **or** 0.25

*allow **1** mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown*
or
*answers of 25 with a unit **or** 0.25 with a unit gain **1** mark*
*answers of 25 without a unit **or** 0.25% gain **1** mark*

2

(c) the information board can be used anywhere it is needed

1

[6]

3 (a) (i) 5.88 (watts)

*an answer of 5.9 scores **2** marks*
*allow **1** mark for correct substitution ie*

$0.42 = \frac{\text{power out}}{14}$
*allow **1** mark for an answer of 0.0588 or 0.059*

2

(ii) 8.12

allow 14 – their (a)(i) correctly calculated

1

(b) (i) input power / energy would be (much) less (reducing cost of running)

accept the converse
electricity is insufficient

1

(also) produce less waste energy / power

accept 'heat' for waste energy

1

(as the waste energy / power) increases temperature of the cabinet

1

so cooler on for less time

1

(ii) line graph

need to get both parts correct

accept scattergram or scatter graph

both variables are continuous

allow the data is continuous

1

(c) number of bulbs used-halogen=24 (LED=1)

1

total cost of LED = £30 + £67.20 = £97.20

accept a comparison of buying costs of halogen £36 and LED £30

1

total cost of halogen= 24 x £1.50 + 24 x £16.00 = £420

or

buying cost of halogen is £36 **and** operating cost is £384

accept a comparison of operating costs of halogen £384 and LED £67.20

*allow for **3** marks the difference in total cost is £322.80 if the number 24 has not been credited*

1

statement based on correct calculations that overall LED is cheaper

*must be **both** buying **and** operating costs*

an alternative way of answering is in terms of cost per hour:

buying cost per hour for LED $\left(\frac{£30.00}{48000}\right)$ = 0.0625p/£0.000625

buying cost per hour for halogen = $\left(\frac{£1.50}{2000}\right)$ = 0.075p/£0.00075

*a calculation of both buying costs scores **1** mark*

operating cost per hour for LED = $\left(\frac{£67.20}{48000}\right)$ = 0.14p/£0.0014

operating cost per hour for halogen= $\left(\frac{£16.00}{2000}\right)$ = 0.8p/£0.008

*a calculation of both operating costs scores **1** mark*

all calculations show a correct unit

***all** units correct scores **1** mark*

statement based on correct calculations of **both** buying **and** operating costs, that overall LED is cheaper

*correct statement scores **1** mark*

1

[12]

4 (a) (i) changing the distance may / will affect / change the voltmeter reading

accept so only one independent variable

accept distance affects speed of wind (turbine)

accept it is a control variable

accept to give valid results

fair test is insufficient

to make the results accurate is insufficient

1

(ii) any sensible practical suggestions, eg

- so fan reaches a steady / full speed

  accept power for speed

- so wind (turbine) reaches a steady / full speed

- so voltmeter reaches / gives a steady reading

  accept accurate or valid reading a correct reading is insufficient

  *do **not** accept precise reading*

1

(iii) as the number of blades increases so does the (voltmeter) reading / output / voltage

number of blades affects the reading / output is insufficient

1

further relevant detail, eg

- voltmeter increase is greatest up to 3 blades
- voltmeter reading hardly changes with 4, 5 or 6 blades
  accept does not change between 4 and 6 blades
- increase is directly proportional up to 3 blades
- it reaches a limit
  accept does not change after 4 / 5 blades
- a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V

1

(b) C

reason scores only if C is chosen

1

wind speed / strength varies

*accept wind is **not** constant / reliable*

1

[6]

5 (a) potential

1

(b) (i) 13 200

*allow **1** mark for correct substitution, ie 660 × 20 provided no subsequent step shown*

2

(ii) 16.5

allow 1 mark for correct

or

$\frac{\text{their (b)(i)}}{800}$ correctly calculated

substitution, ie $\frac{13\,200}{800}$ ***or*** $\frac{\text{their (b)(i)}}{800}$

provided no subsequent step shown

2

[5]

6 (a) 13 500 (J)

*allow **1** mark for correct substitution, ie 90 x 10 x 15 provided no subsequent step shown*

2

(b) 17

or

$\sqrt{\frac{\text{their (a)}}{45}}$

correctly calculated and answer given to 2 or 3 significant figures

accept 17.3

*allow **2** marks for an answer with 4 or more significant figures, ie 17.32*

or

*allow **2** marks for correct substitution, ie 13 500/ their (a) = ½ x 90 x v^2*

or

*allow **1** mark for a statement or figures showing KE = GPE*

3

(c) work is done

1

(against) friction (between the miner and slide)

*accept 'air resistance' **or** 'drag' for friction*

1

(due to the) slide not (being perfectly) smooth

accept miners clothing is rough

or

causing (kinetic) energy to be transferred as heat/internal energy of surroundings

accept lost/transformed for transferred

accept air for internal energy of surroundings

1

[8]