Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

A332/02

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

Unit 2: Modules P4 P5 P6 (Higher Tier)

THURSDAY 2 FEBRUARY 2012: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

DC (SJF/SW) 12MPE01197 57550/1

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **A list of physics equations is printed on pages 4 and 5.**
- **The total number of marks for this paper is 42.**

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TWENTY FIRST CENTURY SCIENCE EQUATIONS

USEFUL RELATIONSHIPS

EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Answer ALL the questions.

1 Barry decorates his house with Christmas lights.

(a) Barry uses an LDR in the circuit so that the lights switch on automatically at night.

(i) One property of an LDR changes when it gets dark.

Put a (ring) around the property that changes when it gets dark.

efficiency

resistance

temperature

Put a (ring) around the correct option to show how this property changes when the light intensity decreases.

increases

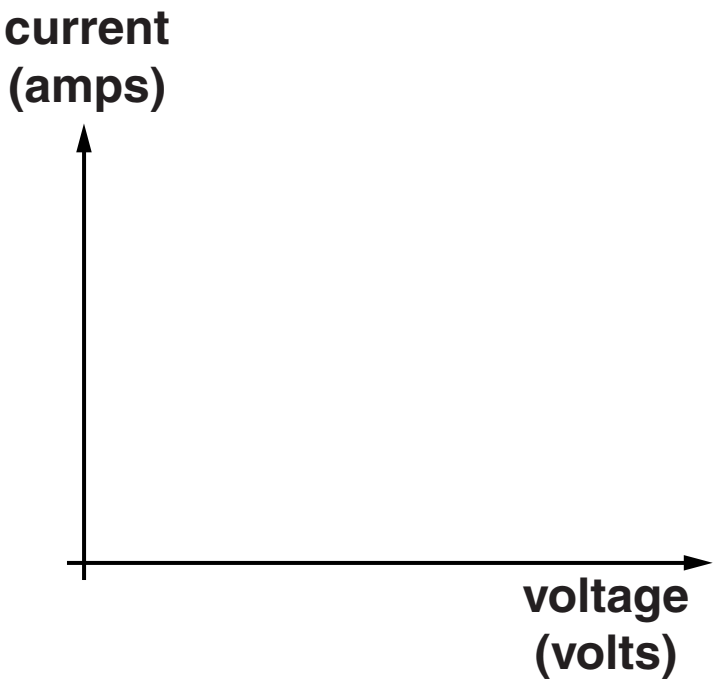
decreases

stays the same **[1]**

(ii) The circuit also contains fixed resistors.

Sketch a graph on the axes below to show how the current varies with voltage for a fixed resistor.

The temperature of the resistor does not change.



[1]

(b) Each of the light bulbs on Barry's house has a value of 15 W.

What does this mean?

Put a tick (✓) in the box next to the correct answer.

The bulb...

... has an efficiency of 15%. ☐

... uses 15 amps of current. ☐

... uses a potential difference of 15 volts. ☐

... transfers 15 joules of energy every second. ☐

[1]

(c) Each light bulb has a filament inside.

Explain why the filament glows when the light bulb is switched on.

_____

_____

_____ **[2]**

(d) Barry used the lights for 20 nights, for 10 hours each night.

The total power used by the light bulbs was 1.5 kW.

The cost per kWh was 10p.

How much does Barry have to pay for the electricity used by the lights?

Put a (ring) around the correct answer.

£0.30

£30.00

£300.00

£30 000.00 **[1]**

[Total: 6]

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Question 2 starts on page 12

2 This question is about a wind turbine.

(a) The turbine blades are attached to a generator.

In the generator there is a magnet inside a coil of wire.

Here are five statements about how the wind turbine supplies electricity to the National Grid.

They are in the WRONG ORDER.

A A voltage is induced across the ends of the coil.

B The magnet rotates inside the coil.

C The voltage is increased by a transformer.

D There is a current in the wire.

E The wind turns the turbine blades.

Fill in the boxes with the letters A, B, C, D and E to show the correct order.

[1]

(b) What would INCREASE the current in the coil around the magnet?

Put ticks (✓) in the boxes next to the TWO correct answers.

placing an aluminium core inside the coil	☐
decreasing the strength of the magnet	☐
increasing the speed of rotation of the magnet	☐
heating the coil of wire	☐
decreasing the resistance of the wire	☐

[2]

(c) The National Grid transmits electricity around the country using alternating current (a.c.).

State TWO reasons why a.c. is used instead of d.c.

_____

_____

_____

_____ **[2]**

(d) A ‘step up’ transformer is used to increase voltage.

Describe the main features of the construction of a transformer that increases voltage.

You may include a labelled diagram.

_____

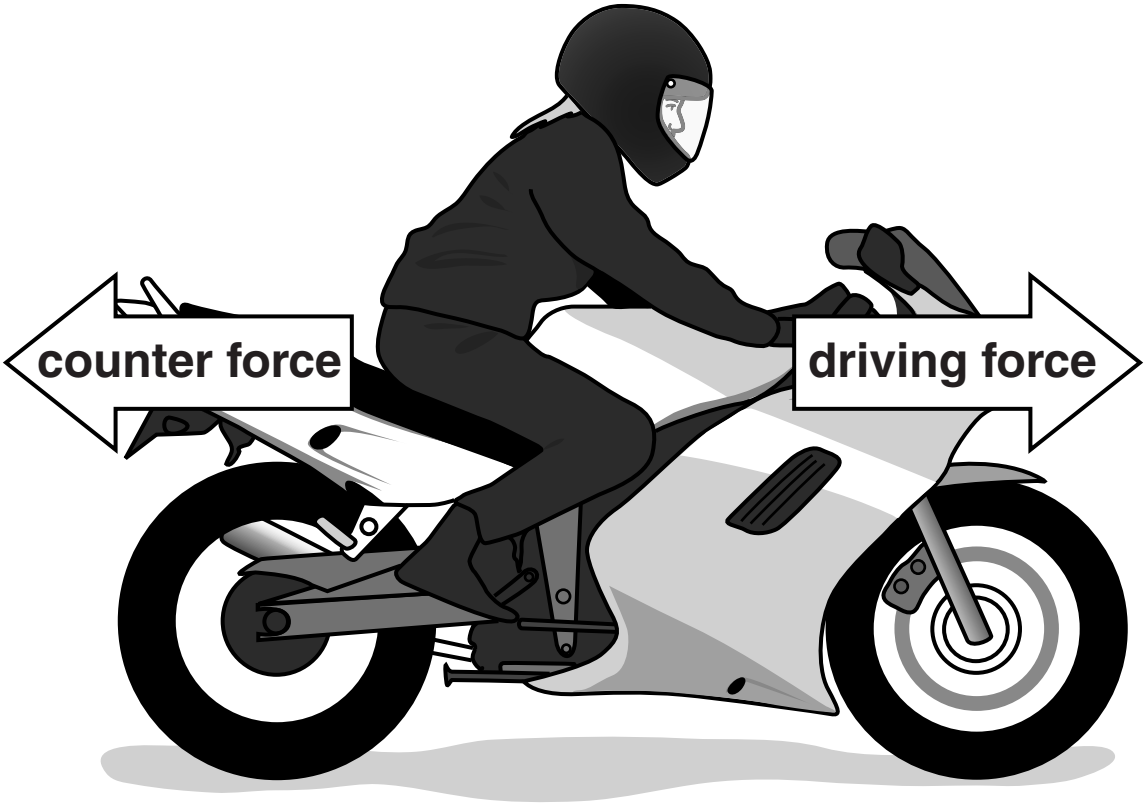
_____

_____ **[2]**

[Total: 7]

3 Nadia rides a motorbike.

(a) The picture shows two of the forces acting on Nadia's motorbike.



The motion of the motorbike depends on the size of each force.

(i) **Draw THREE straight lines to show what happens to the SPEED OF THE MOTORBIKE as the FORCES change.**

SPEED OF THE MOTORBIKE	FORCES
changes from 20 m/s to 25 m/s	the driving force is THE SAME AS the counter force
changes from 20 m/s to 15 m/s	the driving force is GREATER THAN the counter force
stays CONSTANT at 20 m/s	the driving force is SMALLER THAN the counter force

[1]

(ii) Which of these statements is TRUE?

Put a tick (✓) in the box next to the correct statement.

The motorbike's momentum is always zero when the driving force is equal to the counter force. ☐

The motorbike's momentum decreases when its kinetic energy increases. ☐

The motorbike's momentum does not change when the resultant force on the motorbike is zero. ☐

The motorbike's momentum increases when the driving force is smaller than the counter force. ☐

[1]

(b) The total mass of Nadia and the motorbike is 250 kg.

The speed of the motorbike is 20 m/s.

(i) Calculate the kinetic energy of Nadia and the motorbike.

Show your working.

kinetic energy = _____ J [2]

(ii) Nadia slows down and stops on a flat and level road.

Describe the energy transfers that take place when she slows down and stops.

_____

_____

_____

_____ **[2]**

(iii) Nadia takes 5 seconds to slow down from 20 m/s and stop.

Calculate the average force used to stop Nadia and the motorbike.

force = _____ N [2]

[Total: 8]

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Question 4 starts on page 22

4 Emily uses an exercise bike in her gym.

The exercise bike uses friction against a rotating wheel to make it feel like the rider is cycling along a road.

(a) The following measurements are shown on the screen of the bike.

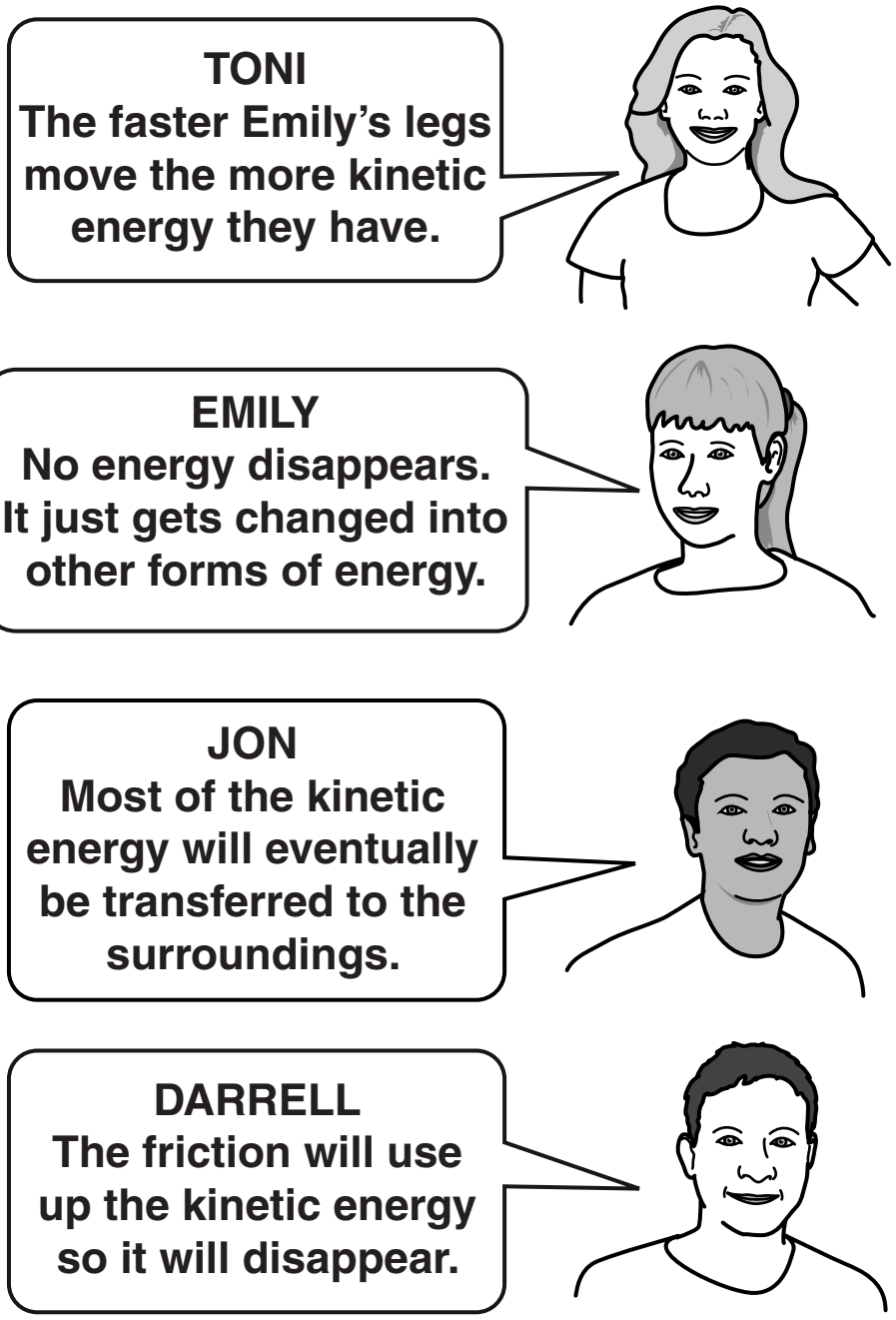
distance travelled	**1.5 km**
energy used	**75 000 J**

Calculate the force of friction on the wheel.

Show your working.

force = _____ N [2]

(b) Emily and her friends discuss the energy transfers that take place when she uses the exercise bike.



Which person is making an INCORRECT statement?

answer _____ **[1]**

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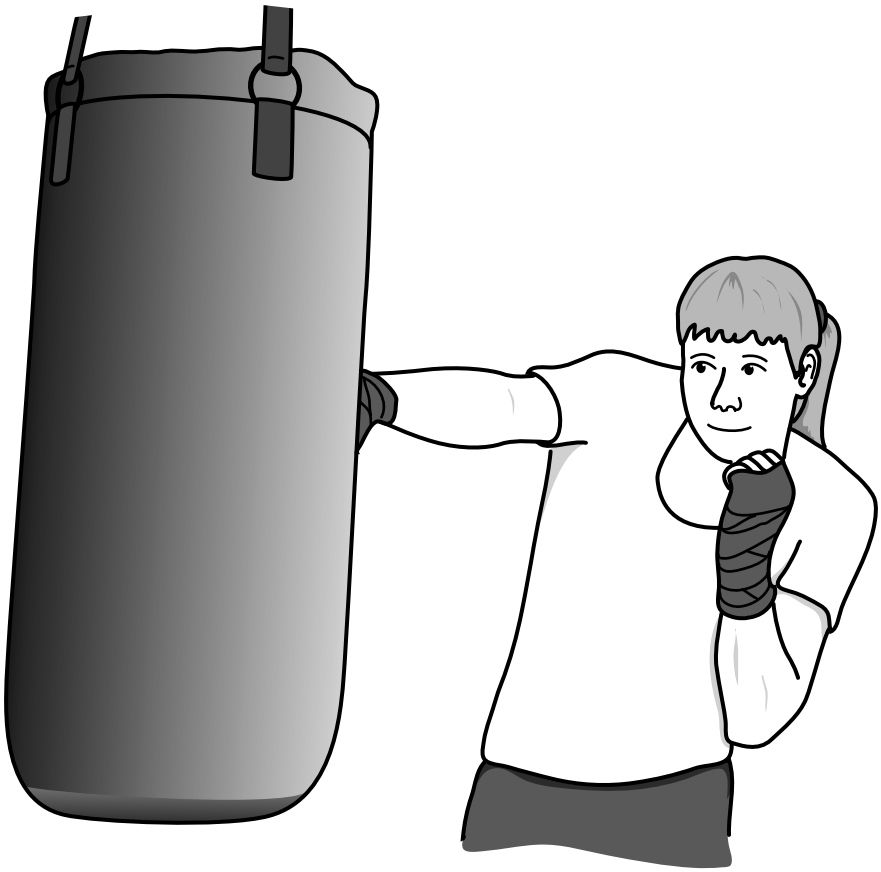
Question 4 (c) starts on page 26

(c) Emily uses a punch bag.



Emily punches the bag. The bag moves.

Some of the following statements are true and some are false.

Put one tick (✓) in each row to show whether the statement is TRUE or FALSE.

	TRUE	FALSE
Work is done by the force of the punch on the bag.	☐	☐
The maximum kinetic energy gained by the bag is equal to the work done on the bag.	☐	☐
Emily has the same energy as the bag after she has hit it.	☐	☐
The kinetic energy gained by the bag is proportional to its speed after it is hit.	☐	☐
When a force on the bag causes it to move faster, the force must be doing work on the bag.	☐	☐

[3]

(d) Two forces form an interaction pair when Emily hits the punch bag.

Put (rings) around the TWO forces that make up the interaction pair.

air resistance acting on the punch bag

Emily's weight

force from Emily's hand onto the punch bag

force of air resistance acting against Emily's hand

the punch bag pushing Emily's hand

friction from Emily's hand on her gloves

[1]

[Total: 7]

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Question 5 starts on page 30

5 Lucas shines a laser through two narrow slits onto a wall.

He notices that there are lighter and darker patches in the light on the wall.

(a) He writes an explanation.

Complete the explanation by filling in the missing words.

Use words from this list.

amplitudes

constructive

destructive

diffraction

frequencies

refraction

reflection

wavelengths

The light from the laser travels as waves.

As the light passes through the slits, it spreads out. This is called _____ .

Where two waves meet, their _____ add and this is called interference.

When two waves arrive in step they reinforce. This is called _____ interference.

When two waves arrive out of step they cancel out.

Darker patches are caused when there is _____ interference. **[3]**

(b) Lucas' teacher tells him that light travels as waves.

Which TWO effects can ONLY be explained by light travelling as a wave?

Put ticks (✓) in the boxes next to the TWO correct answers.

absorption of light	☐
constant speed of light through space	☐
diffraction of light	☐
interference of light	☐
reflection of light	☐

[2]

(c) Lucas makes a table showing parts of the electromagnetic spectrum.

He adds typical wavelengths.

He then uses the speed of light (3×10^8 m/s) to calculate the frequencies.

Complete the table opposite to show the missing parts of the electromagnetic spectrum, the missing wavelength, and the missing frequency.

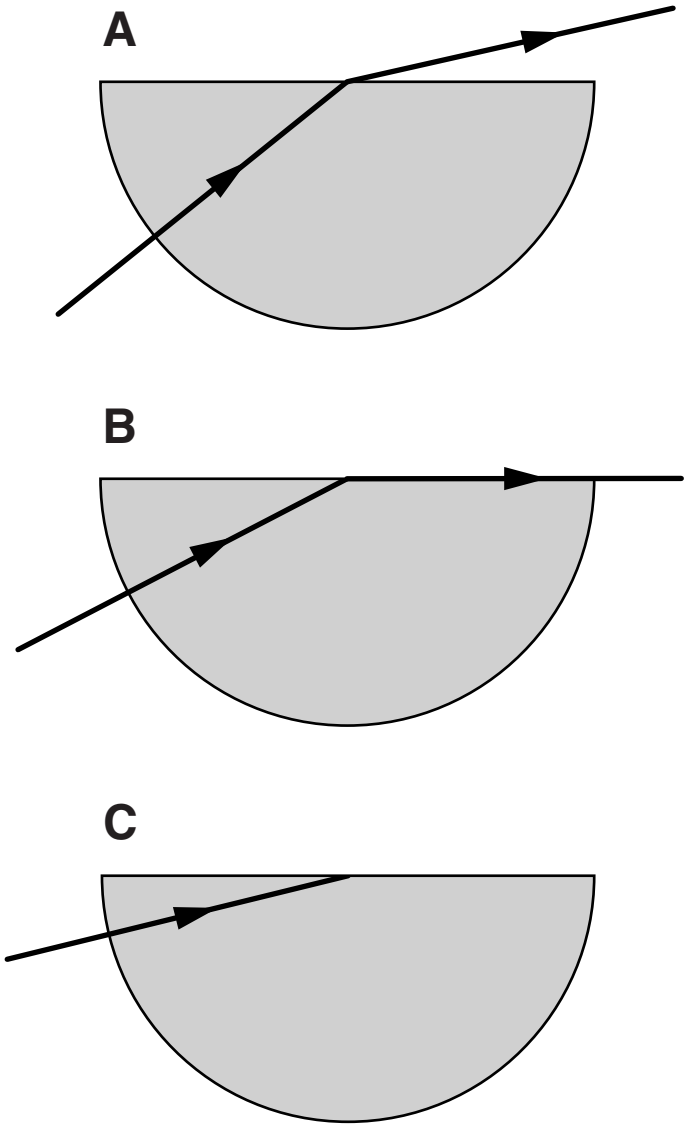
[3]

[Total: 8]

33

	_____	X-rays	ultraviolet	visible light	_____	_____	radio waves
wavelength in m	1×10^{-11}	1×10^{-9}	_____	5×10^{-7}	1×10^{-4}	3×10^{-2}	6
frequency in Hz	3×10^{19}	3×10^{17}	5×10^{15}	6×10^{14}	3×10^{12}	1×10^{10}	_____

6 Jon is doing an experiment.
He shines a ray of light into a semicircular glass block from different angles.



(a) (i) Complete diagram C to show how the light would act at the boundary of the glass block. [1]

(ii) Complete the sentences below to explain this effect.

Use the words from this list.

Each word can be used ONCE, MORE THAN ONCE, or NOT AT ALL.

30

90

180

diffraction

external

internal

refraction

reflection

This effect is called total _____

_____ .

The effect happens when the angle of

_____ would be greater than

_____ degrees. [3]

(iii) The SAME effect is used in some communication systems.

Which of these communication systems uses this effect?

Put a (ring) around the correct answer.

digital radio

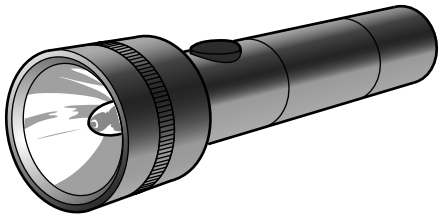
mobile phones

optical fibres

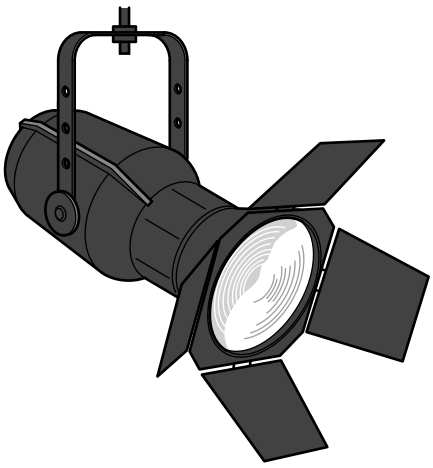
satellite transmission **[1]**

(b) Here are two different sources of light.

torch



spotlight



The light from the torch is not as bright as the light from the spotlight.

Both give out light of the same frequencies.

Which PAIR of statements explains the difference?

Put a tick (✓) in the box next to the correct answer.

NUMBER OF PHOTONS FROM THE SOURCE	ENERGY OF THE PHOTONS	
greater from the torch	greater from the torch	
greater from the torch	greater from the spotlight	
greater from the torch	same for both	
greater from the spotlight	greater from the torch	
greater from the spotlight	greater from the spotlight	
greater from the spotlight	same for both	

[1]

[Total: 6]

END OF QUESTION PAPER

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