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RECOGNISING ACHIEVEMENT

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A332/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

PHYSICS A

UNIT 2: Modules P4 P5 P6 (Higher Tier)

FRIDAY 20 JUNE 2008

Morning

Time: 40 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T44396

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE		
Qu.	**Max**	**Mark**
1	4	
2	4	
3	5	
4	5	
5	5	
6	4	
7	5	
8	5	
9	5	
TOTAL	42	

This document consists of **19** printed pages and **1** blank page.

EQUATIONS

Useful Relationships

Explaining Motion

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

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved by the force

change in energy = work done

change in GPE = weight × vertical height difference

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

Electric Circuits

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

energy transferred = power × time

power = potential difference × current

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

The Wave Model of Radiation

wave speed = frequency × wavelength

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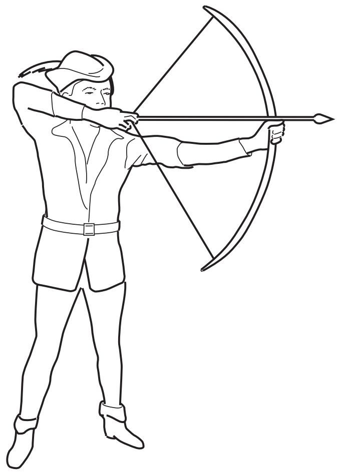
Question 1 starts on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Seb shoots an arrow horizontally from a bow.



(a) Which of these statements are correct as the arrow is released?

Put ticks (✓) in the boxes next to the **three** correct statements.

The bow loses energy.	☐
The arrow gains momentum.	☐
The arrow loses kinetic energy.	☐
The bow does work on the arrow.	☐
The bow gains gravitational potential energy.	☐
The arrow gains gravitational potential energy.	☐

[2]

(b) The arrow leaves the bow horizontally over level ground.

After a flight of a few seconds it hits the ground.

Here are three sentences about the flight of the arrow.

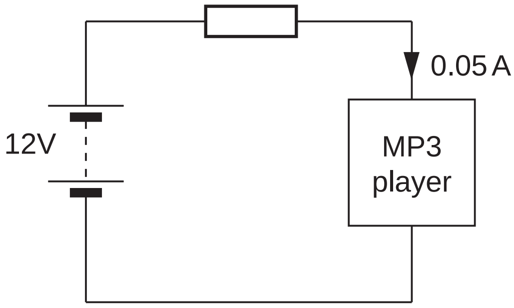
Draw a straight line from the **start** of each sentence to its correct **end**.

start	**end**
The force of gravity on the arrow ...	... is reduced by heating the air.
The energy of the arrow ...	... decreases the arrow's kinetic energy.
The friction of the air ...	... increases its downwards momentum.

[2]

[Total: 4]

2 Jo uses this circuit to run her MP3 player from a 12 V car battery.



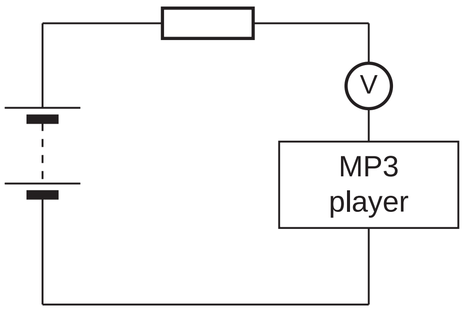
(a) Complete the sentences about the circuit. Choose from this list.

greater than **smaller than** **the same as**

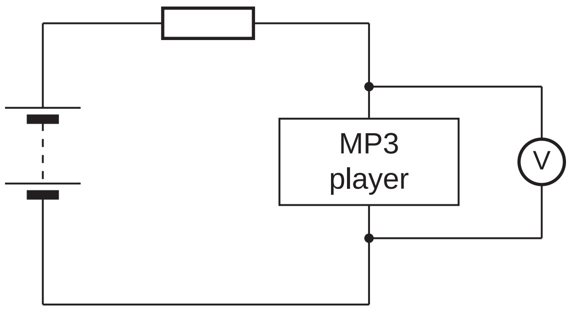
The current in the resistor is …………………………………. the current in the MP3 player.

The voltage across the battery is …………………………………. the voltage across the MP3 player. [2]

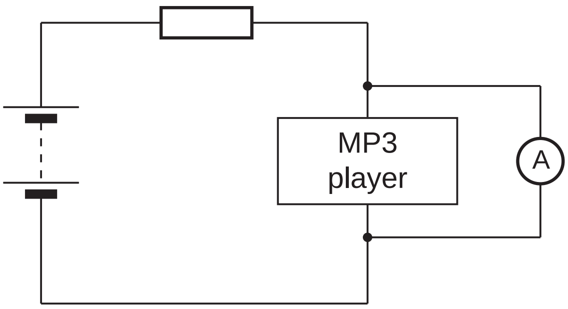
(b) The potential difference across the MP3 player can be measured with a meter.



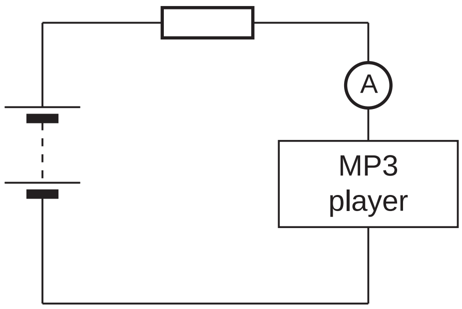
P



Q



R



S

Which diagram, **P**, **Q**, **R** or **S**, shows how a meter should be connected to measure the potential difference across the MP3 player?

answer .... [1]

(c) The MP3 player requires a potential difference of 3 V to operate properly.

It draws a current of 0.05 A from the car battery.

What is the power of the MP3 player?

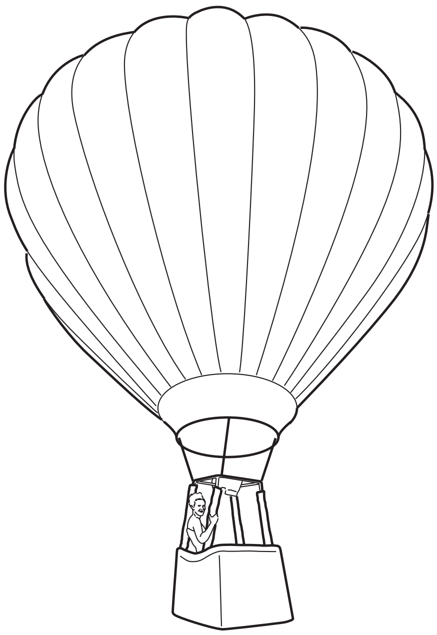
Put a ring around the correct answer.

0.15 W **0.6 W** **3 W** **60 W**

[1]

[Total: 4]

3 Simona goes for a ride in a hot air balloon.



There is an upwards force on the balloon from the air around it. This force is called **upthrust**.

(a) The balloon stays still in the air.

Complete the sentence. Choose from this list.

equal to **greater than** **smaller than**

The upthrust is …………………………………… the weight of the balloon. [1]

(b) Simona stands still.
Her weight acts downwards.

Which of the forces below is caused by Simona's weight?

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

the weight of the hot air in the balloon ☐

the upthrust of the air under the balloon ☐

the friction of the surface under her feet ☐

the reaction of the surface under her feet ☐

[1]

(c) Later on, the balloon rises 100 m in 40 s.
Simona has a mass of 80 kg and a weight of 800 N.

(i) How much gravitational potential energy does she gain in the 40 s?

Put a ring around the correct answer.

3200 J **8000 J** **32 000 J** **80 000 J** [1]

(ii) How should she calculate her kinetic energy?

Put a ring around the correct calculation.

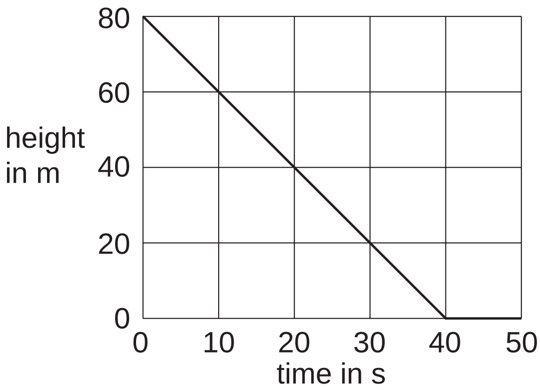
$\frac{1}{2} \times 800 \times \left(\frac{100}{40}\right)^2$ $\frac{1}{2} \times 80 \times \left(\frac{100}{40}\right)^2$

$\frac{1}{2} \times 80 \times \left(\frac{40}{100}\right)^2$ $\frac{1}{2} \times 800 \times \left(\frac{40}{100}\right)^2$

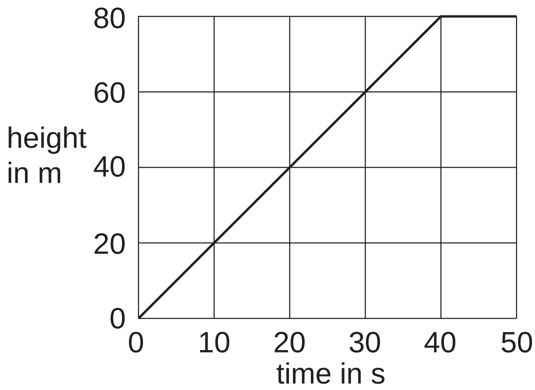
[1]

(d) At the end of the flight, the balloon falls the last 80 m at a steady speed of 2 m/s.
Here are some height-time graphs for the end of the flight.

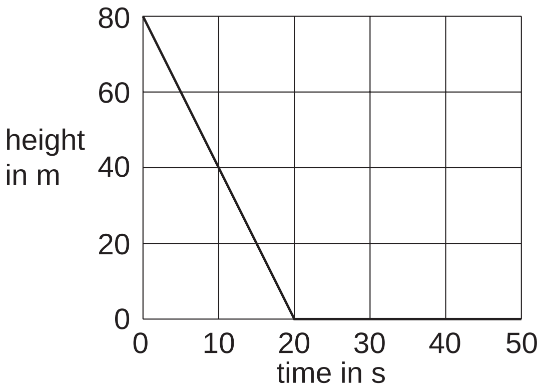
A



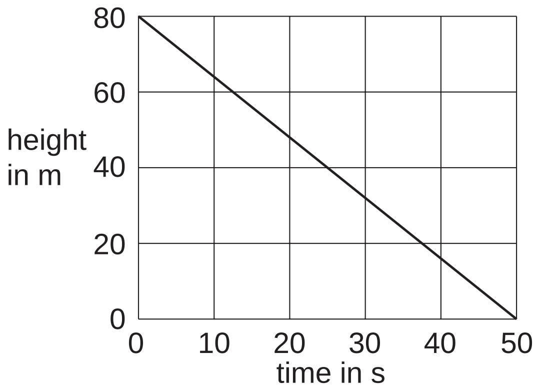
B



C



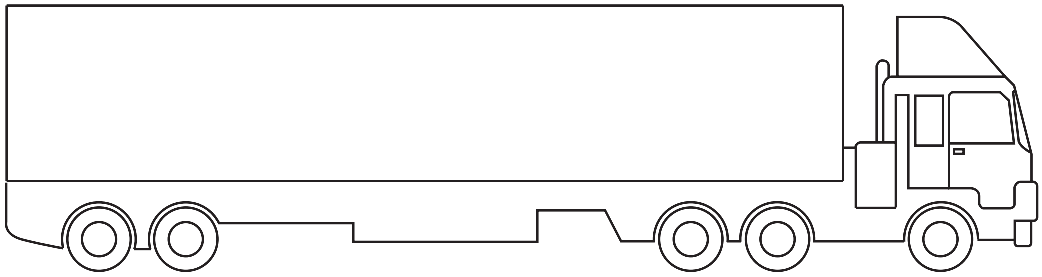
D



Which graph, **A**, **B**, **C** or **D**, is correct? answer .... [1]

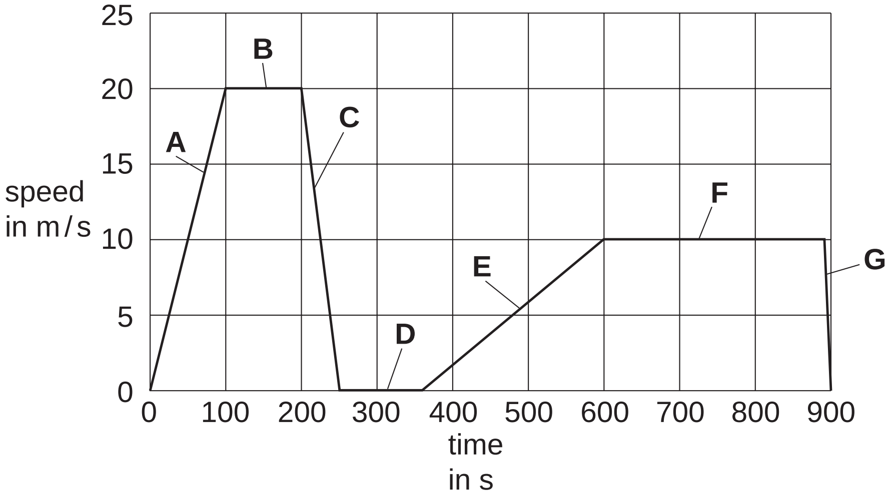
[Total: 5]

4 This question is about the speed of a lorry.



The lorry makes a short journey.

The tachograph records the journey as this speed-time graph.



(a) Here are some statements about the motion of the lorry.

Which region of the graph, **A**, **B**, **C**, **D**, **E**, **F** or **G**, best fits each statement?

Write the **one** correct letter in the box next to each statement.

stopped at traffic lights	
making an emergency stop	
moving at the fastest speed of the journey	

[3]

(b) At one point in the journey, the driver has to make an emergency stop.

His momentum changes from 800 kg m / s to zero in 5 s.

(i) Which of these calculations gives the force needed to slow down the driver?

Put a ring around the correct answer.

$$\mathbf{\frac{5}{800}} \qquad \mathbf{800 \times 5} \qquad \mathbf{\frac{800}{5}}$$

[1]

(ii) Lorry drivers do not have to wear seatbelts.

Which of these forces could slow down the driver when his lorry stops?

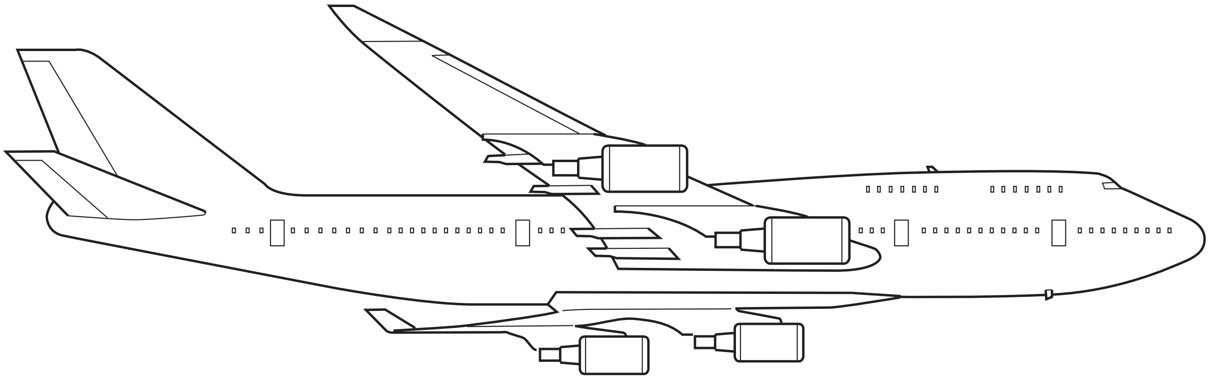
Put a tick (✓) in the box next to the **one** correct answer.

the weight of the driver	☐
the friction from the driver's seat	☐
the reaction force from the driver's seat	☐
the friction between the ground and the tyres	☐

[1]

[Total: 5]

5 Some planes become electrically charged as they fly through the air.



(a) Complete the sentences. Choose the **best** words from this list.

atoms **current** **electrons** **negative** **positive** **power** **voltage**

As the plane moves through the air, it picks up ………………………… from the air around it.

This gives the plane ………………………… charge.

The flow of charge is called ………………………… . [2]

(b) When the plane lands, it is connected to the ground by a thick metal wire.

This discharges the plane.

(i) Why does a metal wire have to be used to discharge the plane?

Write **T** in the box next to each **true** statement and **F** in the box next to each **false** one.

	T (true) or **F** (false)
Metals are good insulators of electricity.	
The wire contains charges which can move freely.	
The plane and the ground have the same charge.	
Charges cannot move freely through the rubber tyres.	

[2]

(ii) When the plane is connected to the ground by the metal wire, 460 J of electrical energy is transferred in 0.2 s.

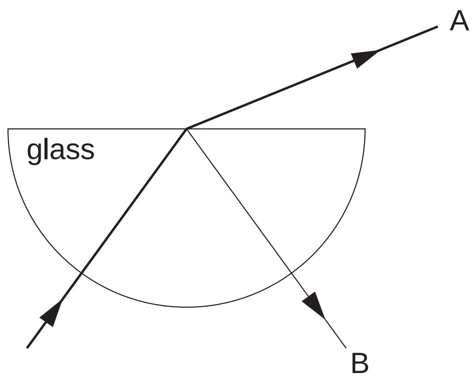
What is the power during this time?

Put a ring around the correct answer.

92 W **230 W** **920 W** **2300 W** [1]

[Total: 5]

6 A beam of light passes into a transparent block of glass.



(a) Two beams of light, **A** and **B**, emerge from the block.

Draw a straight line from each **beam** to its correct **description**.

beam	**description**
	reflected beam
A	
	diffracted beam
	refracted beam
B	
	interfered beam

[2]

(b) Complete the sentences about the beam of light as it leaves the glass.

Choose words from this list.

colour **decreased** **frequency**

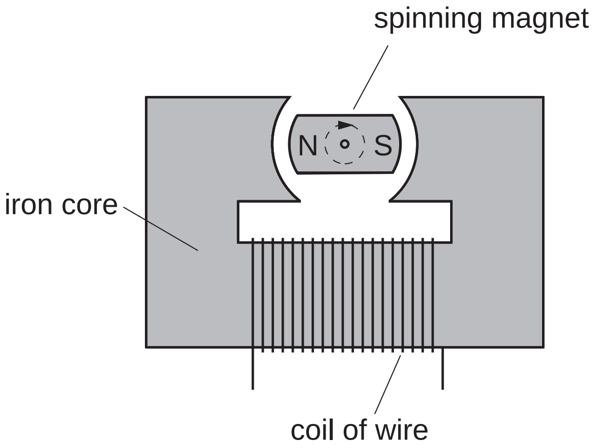
increased **unchanged** **wavelength**

As the light leaves the glass, its speed is ………………………………………… .

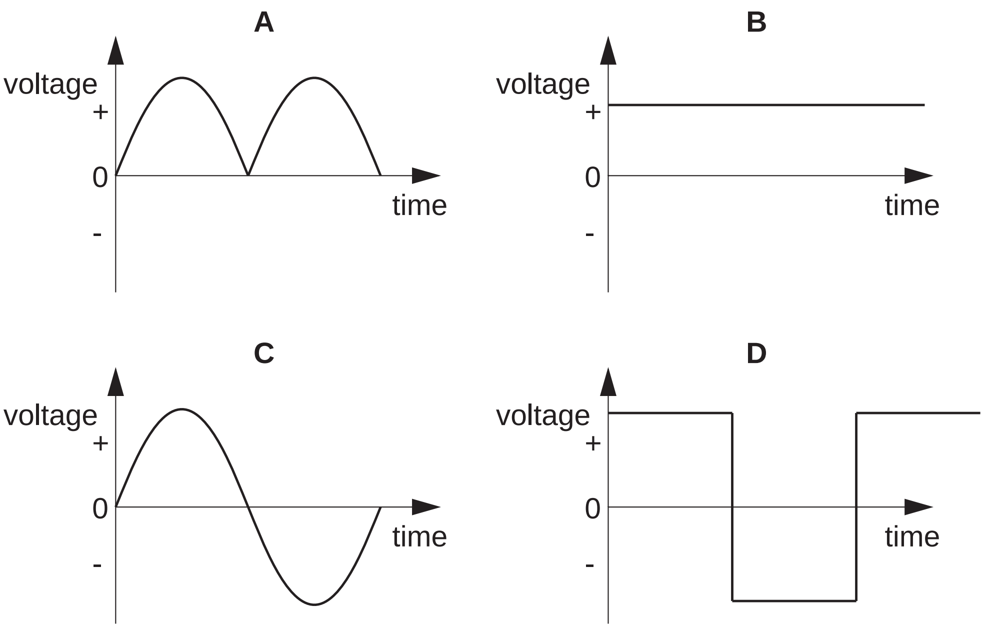
This changes its ………………………………………… . [2]

[Total: 4]

7 Power stations generate electricity by spinning magnets close to a coil of wire.



(a) Here are some voltage-time graphs for the voltage across the coil of wire as the magnet spins round.



(i) Which **one** graph, **A**, **B**, **C** or **D**, is correct?

answer .... [1]

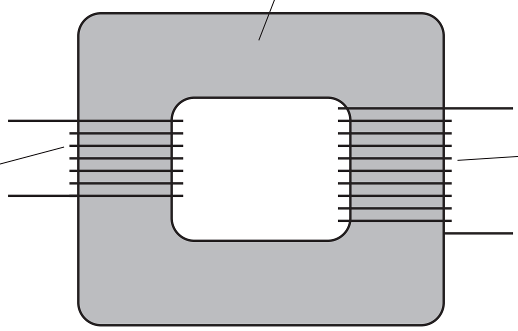
(ii) What is the name for the current produced by this generator?

Put a ring around the correct answer.

alternating **circular** **direct** **revolving**

[1]

(b) Electricity from a power station is transferred to the National Grid through a transformer.



(i) Complete the sentences. Choose words from this list.

charge **current** **efficiency** **power** **safety** **speed** **voltage**

A transformer increases the ……………………………… of the electricity from the power station.

This increases the ……………………………… of energy transfer from the power station to the consumers. [2]

(ii) These sentences describe how a transformer operates.
They are in the wrong order.

A The current in the primary coil changes.

B The magnetic field in the core changes.

C The voltage across the primary coil changes.

D A voltage is induced across the secondary coil.

Fill in the boxes to show the correct order. The first one has been done for you.

C			

[1]

[Total: 5]

8 Jane drops a weight on her hand. The doctor uses an X-ray photo to assess the damage.

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(a) Here are some sentences about the X-ray photo.

Draw a straight line from the **start** of each sentence to its correct **end**.

start	**end**
Jane's hand …	… emits a stream of high energy photons.
The X-ray source …	… shows where X-rays have been absorbed.
A black part of the photo …	… shows where X-rays have been transmitted.
A white part of the photo …	… is placed between the X-ray source and the film.

[2]

(b) Complete the sentences. Choose the best words from this list.

charge **energy** **frequency** **power**

photons **speed** **wavelength**

The intensity of a beam of X-rays is the ………………………….… it transfers every second.

The energy of a photon increases when its ……………………………… is increased. [2]

(c) An image of the broken bone in Jane's hand can also be made with high frequency sound waves.

Sound waves and X-rays have different properties.
For example, sound is a longitudinal wave.

Draw a straight line from each **wave** to its correct **property**.

wave	**property**
X-ray	transfers energy by transferring matter
	travels through both matter and empty space
sound	vibrates matter parallel to the direction of energy flow

[1]

[Total: 5]

9 Sam is a singer. She uses a radio microphone.

(a) The microphone transmits Sam's sound as a digital signal.
The signal is carried by a radio wave.

The sentences below describe this process.
They are in the wrong order.

A The radio wave is pulsed on to transmit a 1.

B The sound is converted into a code of 1s and 0s.

C The code of 1s and 0s is converted into the sound.

D As the wave travels to the receiver, it picks up noise.

E The radio wave pulses are absorbed by the receiver.

Fill in the boxes to show the correct order. The first one has been done for you.

B				

[3]

(b) The sound at the receiver is of high quality.
What is the reason for this?

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

The amplifier in the receiver increases the noise in the signal. ☐

The transmitted pattern of pulses can be recognised at the receiver. ☐

The receiver is very close to the transmitter, so no noise is picked up. ☐

The code of pulses is sent from the transmitter as an analogue signal. ☐

[1]

(c) The signal from Sam's microphone does not have to be carried by a radio wave.

Here are some other waves which could carry Sam's sound away from the microphone.

Put a ring around the **best** alternative to radio waves.

gamma rays **microwaves** **ultraviolet** **X-rays**

[1]

[Total: 5]

END OF QUESTION PAPER

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