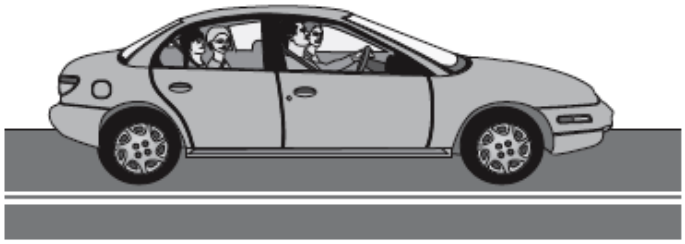
Q1. The figure below shows a car with an electric motor.

The car is moving along a flat road.



(a) (i) Use the correct answers from the box to complete each sentence.

light	**electrical**	**kinetic**	**potential**	**sound**

The car's motor transfers ..... energy

into useful ..... energy as the car moves.

Some energy is wasted as ..... energy.

(3)

(ii) What happens to the wasted energy?

.....

.....

(1)

(b) The electric motor has an input energy of 50 000 joules each second.

The motor transfers 35 000 joules of useful energy each second.

Calculate the efficiency of the electric motor.

Use the correct equation from the Physics Equations Sheet.

.....

.....

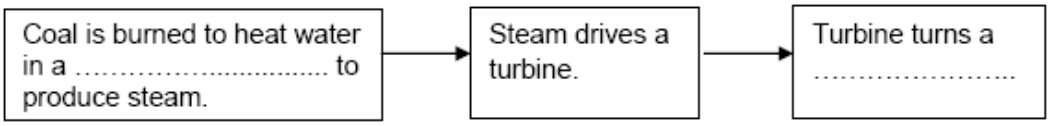
.....

Efficiency = ...

(2)

(Total 6 marks)

Q2. (a) The block diagram shows the important parts of a coal burning power station.

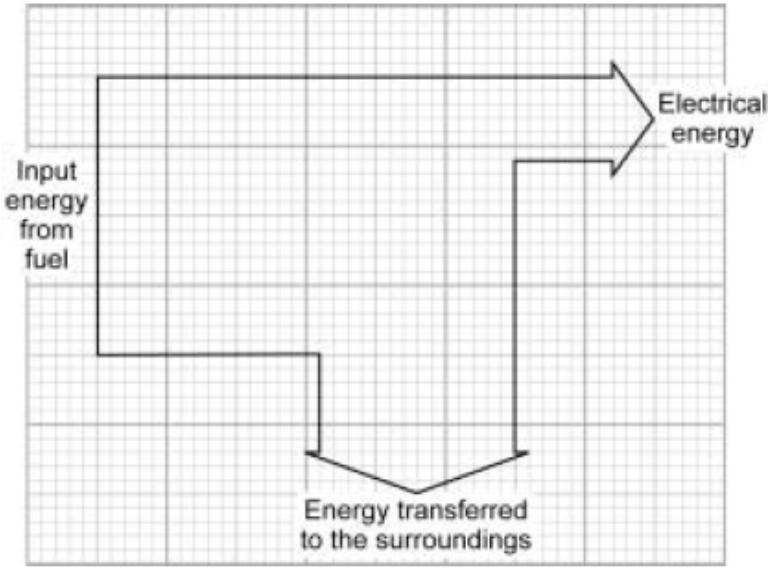


Use words from the box to complete the block diagram

boiler	**condenser**	**furnace**	**generator**

(2)

(b) The diagram shows the energy transformations in a coal burning power station.



Calculate the efficiency of the power station.
Write down the equation you use, and then show clearly how you work out your answer.

.....

.....

.....

Efficiency = ...

(2)

(c) Draw a ring around the correct answer to complete the following sentence.

If fewer coal burning power stations are used to generate electricity the amount of

carbon dioxide emitted into the atmosphere will

decrease.

not change.

increase.

(1)

(d) Some types of power station generate electricity by burning a biofuel.

Give **one** example of a biofuel.

.....

(1)

(e) Nuclear power stations generate electricity without burning a fuel.

Name the process by which a nuclear fuel provides the energy needed to generate electricity.

.....

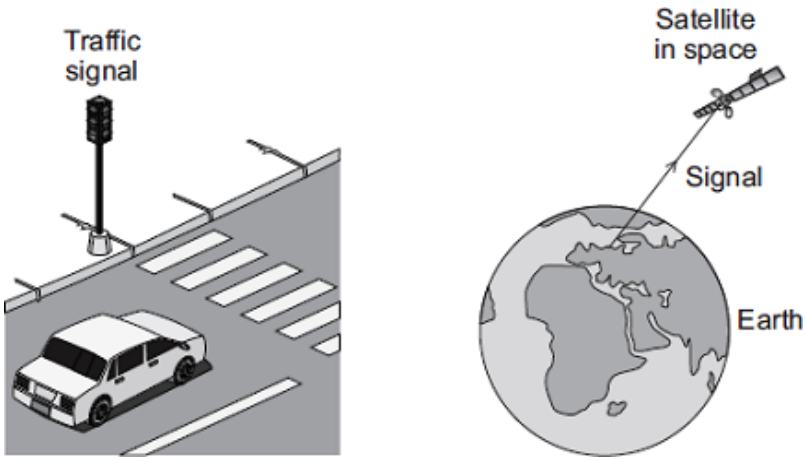
(1)
(Total 7 marks)

Q3. **Diagram 1** shows four of the seven types of wave in the electromagnetic spectrum.

Diagram 1

J	**K**	**L**	Visible light	Infrared	Microwaves	Radio waves

(a) The **four** types of electromagnetic wave named in **Diagram 1** above are used for communication.



(i) Which type of electromagnetic wave is used when a traffic signal communicates with a car driver?

.....

(1)

(ii) Which type of electromagnetic wave is used to communicate with a satellite in space?

.....

(1)

(b) Gamma rays are part of the electromagnetic spectrum.

Which letter, **J**, **K** or **L**, shows the position of gamma rays in the electromagnetic spectrum?

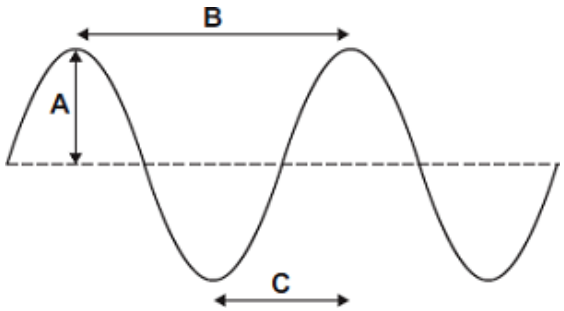
Draw a ring around the correct answer.

J **K** **L**

(1)

(c) **Diagram 2** shows an infrared wave.

Diagram 2



(i) Which **one** of the arrows, labelled **A**, **B** or **C**, shows the wavelength of the wave?

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

(1)

(ii) Draw a ring around the correct answer to complete the sentence.

The wavelength of infrared waves is

shorter than
the same as
longer than

the wavelength of radio waves.

(1)

(d) Mobile phone networks send signals using microwaves. Some people think the energy a person's head absorbs when using a mobile phone may be harmful to health.

(i) Scientists have compared the health of people who use mobile phones with the health of people who do not use mobile phones.

Which **one** of the following statements gives a reason why scientists have done this?

Tick (✓) **one** box.

To find out if using a mobile phone is harmful to health. ☐

To find out if mobile phones give out radiation. ☐

To find out why some people are healthy. ☐

(1)

(ii) The table gives the specific absorption rate (SAR) value for two different mobile phones.

The SAR value is a measure of the maximum energy a person's head absorbs when a mobile phone is used.

Mobile Phone	SAR value in W/kg
X	0.28
Y	1.35

A parent buys mobile phone **X** for her daughter.

Using the information in the table, suggest why buying mobile phone **X** was the best choice.

.....

.....

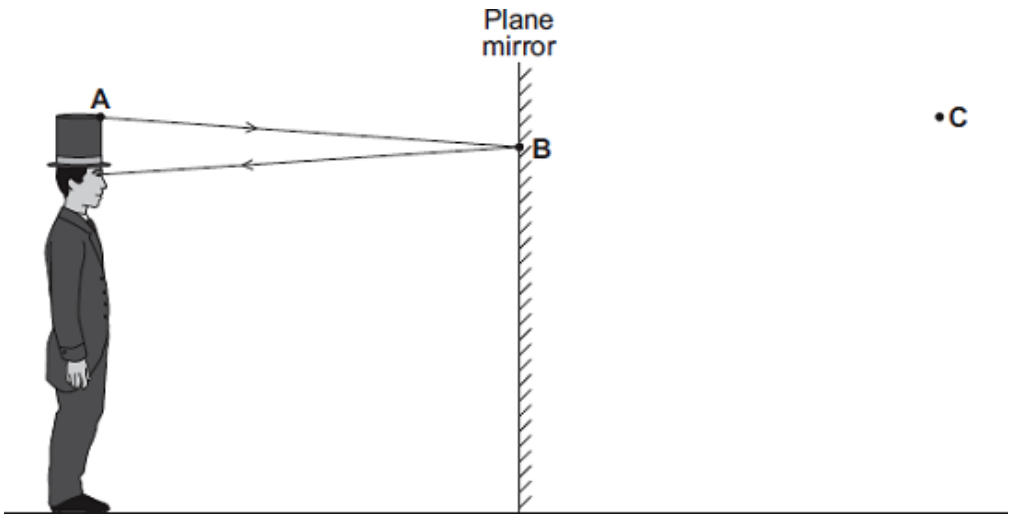
.....

.....

(2)

(Total 8 marks)

Q4. A person can see an image of himself in a tall plane mirror.



The diagram shows how the person can see his hat.

(a) Which point, **A**, **B** or **C**, shows the position of the image of his hat?

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

(1)

(b) On the diagram, use a ruler to draw a light ray to show how the person can see his shoe.

(3)

(c) Which **one** of the words in the box is used to describe the image formed by a plane mirror?

Draw a ring around the correct answer.

imaginary	**real**	**virtual**

(1)

(Total 5 marks)

Q5. The diagram shows some of the kinds of waves in the electromagnetic spectrum. Choose words from this list to complete the empty boxes on the diagram.

alpha radiation **infrared radiation** **radio waves** **X-rays**

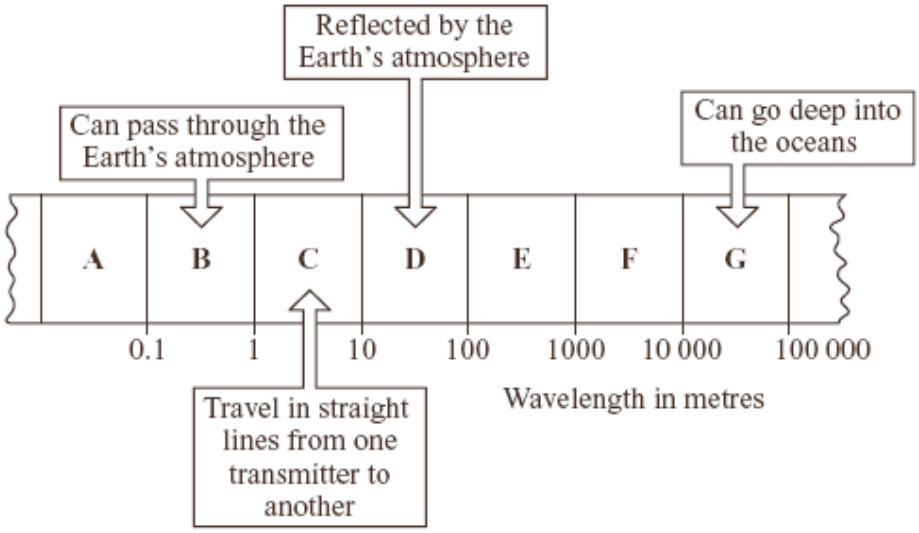
Shortest wavelength → Longest wavelength

gamma radiation		ultraviolet radiation	light		microwaves	

(Total 3 marks)

Q6. The diagram shows a small part of the electromagnetic spectrum divided into seven sections.

The different properties of the waves in each section make them useful in different ways.



The waves in which section, **A**, **B**, **C**, **D**, **E**, **F** or **G**, are:

(a) used to send a signal to a satellite in space

.....

(1)

(b) used to communicate with a submarine under the water

.....

(1)

(c) used by a radio station to broadcast programmes around the world

.....

(1)

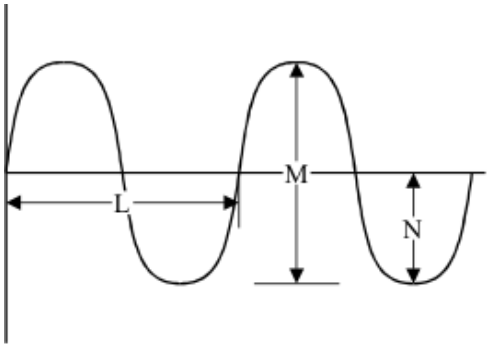
(d) the waves with the shortest wavelength?

.....

(1)

(Total 4 marks)

Q7. (a) The diagram shows a wave pattern.



Which letter, **L**, **M** or **N** shows:

(i) the wavelength? .....

(ii) the amplitude? .....

(2)

(c) Describe how you could show that visible light travels in straight lines. You may wish to draw a diagram to help explain your answer.

.....

.....

.....

.....

.....

(2)
(Total 4 marks)

Q8. (a) A lorry has an air horn. The air horn produces sound waves in the air.

(i) Use **one** word to complete the following sentence.

Sound waves cause air particles to ..... .

(1)

(ii) The air horn produces sound waves at a constant frequency of 420 Hz.

The wavelength of the sound waves is 0.80 m.

Calculate the speed of the sound waves.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ... m/s

(2)

(b) A person standing at the side of the road, as the lorry goes past, hears the sound from the air horn change pitch.

(i) What determines the pitch of a sound?

Draw a ring around the correct answer.

amplitude **frequency** **loudness**

(1)

(ii) As the lorry moves away from the person, the air horn continues to produce sound waves with a wavelength of 0.80 m.

What is the wavelength of the sound waves the person heard?

Draw a ring around the correct answer.

shorter than 0.8 m **equal to 0.8 m** **longer than 0.8 m**

(1)

(iii) The sound waves the person heard from the moving air horn are different to the sound waves the air horn produced.

What name is given to this effect?

Draw a ring around the correct answer.

diffraction **Doppler** **refraction**

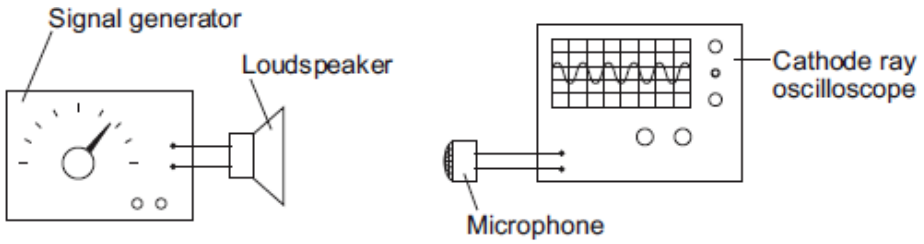
(1)

(Total 6 marks)

Q9. (a) **Figure 1** shows a signal generator connected to a loudspeaker.

The signal generator is adjusted to change the sound wave produced by the loudspeaker.

Figure 1

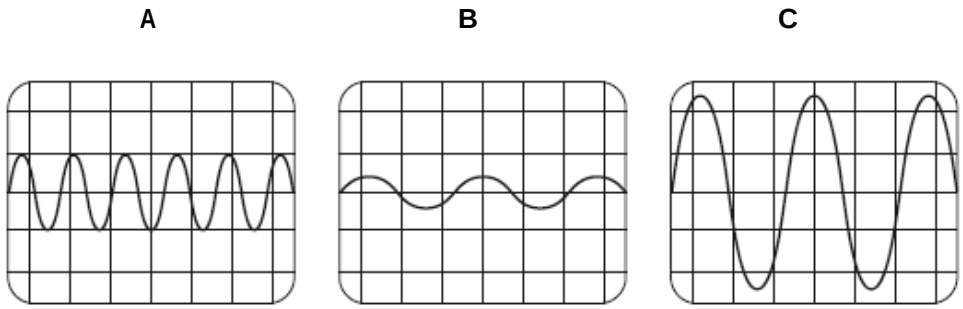


A microphone connected to a cathode ray oscilloscope (CRO) is used to detect the sound waves from the loudspeaker.

Figure 2 shows the CRO traces, **A**, **B** and **C**, produced by three different sound waves.

The settings on the CRO were the same for each trace.

Figure 2



Use the correct letter, **A**, **B** or **C**, to complete each sentence.

(i) The sound wave with the highest frequency is shown by trace ☐.

(1)

(ii) The sound wave with the smallest amplitude is shown by trace ☐.

(1)

(b) The loudspeaker produces a sound wave with a frequency of 850 hertz and a wavelength of 0.4 metres.

Calculate the speed of this sound wave. Give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

joules **metres / second** **watts**

.....

.....

.....

Speed = ...

(3)

(c) A motorbike is driven towards a microphone and CRO which are placed by the side of the road.

The motorbike emits a sound wave of constant frequency.

Draw a ring around the correct answer to complete each sentence.

As the motorbike moves towards the microphone, the frequency of the sound wave

detected by the microphone will be | higher than / the same as / lower than | the frequency of the sound wave

produced by the motorbike.

The wavelength of the sound wave detected by the microphone will be | longer than / the same as / shorter than |

the wavelength of the sound wave from the motorbike.

(2)

(Total 7 marks)

Q10. Light is given out by the Sun and a distant galaxy.

(a) Compared to the light from the Sun, the light from the distant galaxy has moved towards the red end of the spectrum.

(i) What name is given to this effect?

.....

(1)

(ii) Complete the following sentence by drawing a ring around the line in the box that is correct.

The fact that light from a distant galaxy seems to move towards the red end of the spectrum gives scientists evidence that

galaxies are shrinking
galaxies are changing colour
the universe is expanding

(1)

(b) Scientists have a theory that the universe began from a very small point and then exploded outwards.

(i) What name is given to this theory?

.....

(1)

(ii) Which statement gives a reason why scientists think that the universe began with an explosion?

Put a tick (✓) in the box next to your choice.

At the moment it is the best way of explaining our scientific knowledge. ☐

It can be proved using equations. ☐

People felt the explosion. ☐

(1)

(Total 4 marks)

M1. (a) (i) electrical

correct order only

1

kinetic

1

sound

1

(ii) transferred into surroundings / atmosphere

accept warms the surroundings

allow released into the environment

becomes heat or sound is insufficient

1

(b) 0.7 / 70 %

*an answer of 70 without % or with the wrong unit **or** 0.7 with a unit gains **1** mark*

2

[6]

M2. (a) boiler

1

generator

1

(b) 0.3 or 30%

*allow **1** mark for substitution of 2 correct values taken from the Sankey diagram into correct equation*

2

(c) decrease

1

(d) any named biofuel eg wood, ethanol, straw

1

(e) (nuclear) fission

1

[7]

M3. (a) (i) (visible) light

accept visible

1

(ii) microwaves

1

(b) J

1

(c) (i) B

1

(ii) shorter than

1

(d) (i) To find out if using a mobile phone is harmful to health

1

(ii) any **two** from:

- (X has a) low(er) SAR value
  "it" refers to mobile phone
  accept has a low(er) rate
- (maximum) energy absorbed (by the head) is less
  accept energy emitted (by phone) is less
  accept radiation for energy
- (if mobiles are harmful) less likely to cause harm
  accept will not cause harm
  accept it is safer

2

[8]

M4. (a) C

1

(b) reflection at the mirror of ray from shoe to person's eye
may be drawn freehand

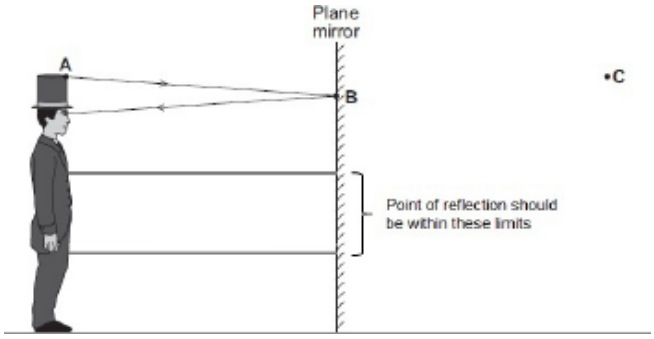
1

angle of incidence = angle of reflection
judged by eye
a ruler must have been used

1

arrow to show correct direction on either incident or reflected ray
only one arrow needed but if more drawn must be no contradiction
both incident and reflected ray must be shown

1



(c) virtual

1

[5]

M5. X-rays {infrared radiation} {radio waves}

for 1 mark each

[3]

M7. (a) (i) L

1

(ii) N

1

(c) the answer should be in the form:

***not** inside the eye*

either for **both** marks an arrangement which could demonstrate visibly light travels in straight lines

full credit should be given for answer presented as a diagram

and

an explanation of how it shows the straightness

or for one mark

named device which uses principle of light travelling in straight lines to work

examples

light (from a street lamp) strikes an object producing a shadow

laser light travelling through (fine) dust shows a straight beam

three pieces of card with central holes need to be lined up to be able to see through the third hole from the first

ray box type experiment using mirrors/prisms, etc

beams on paper or in smoke

torch beams through smoke

example devices:–
–pinhole camera (qualification may get second mark)
–periscope
–optical fibre
*–reflection 'in a **mirror***

2

[4]

M8. (a) (i) vibrate / oscillate

accept a correct description
move is insufficient

1

(ii) 336

*allow **1** mark for correct substitution, ie 420 × 0.8(0) provided no subsequent step shown*

2

(b) (i) frequency

1

(ii) longer than 0.8m

1

(iii) Doppler

1

[6]

M9. (a) (i) A

1

(ii) B

1

(b) 340

*allow **1** mark for correct substitution ie 850 × 0.4*
provided no subsequent step shown

2

metres / second

accept m / s

1

(c) higher than

1

shorter than

1

[7]

M10. (a) (i) red shift

1

accept Doppler effect

(ii) the universe is expanding

1

(b) (i) big bang

1

(ii) at the moment it is the best way of explaining.....

1

[4]