

L2 Lead Examiner Report 1906

June 2019

**L2 Qualification in Applied Science
Unit 1: Applications of Science
(20460E)**

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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:

<http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html>

Unit 1: Applications of Science (20460E)

Grade	Unclassified	Level 1 Pass	Level 2		
			Pass	Merit	Distinction
Boundary Mark	0	14	22	30	39

Introduction to the Overall Performance of the Unit

Learners that did well in this summer series, were able to apply their scientific knowledge to the scenarios posed in the questions. They used good scientific language and were able to apply concepts and key terms. The best learners were able to carry out equations in physics and chemistry, setting out their work clearly and showing their working and be able to apply practical chemistry.

As in previous series, exam technique is still an issue for the weaker learners. Copying the stem of the questions and answering a question that the learner thinks that is posed rather than the question that is posed is still an ongoing problem.

Individual Questions

Question 1(a)(i) was well answered with the majority of learners being able to recall that shivering is a process that happens in a person's body to warm them up when they are too cold.

(a) (i) Give **one** process that happens in the body of person A to warm up their body. (1)

They shiver.

Where learners did not gain this mark, it was often as they had not read the question carefully and referred to processes that would warm up a person's body.

(a) (i) Give **one** process that happens in the body of person A to warm up their body. (1)

Being in a hot place (sun)

Learners found part (a)(ii) of question 1 more difficult. Many learners were able to score 1 mark for stating that a person will sweat to cool down if they are too hot. But fewer were able to name a second process to gain both marks as in this example.

(ii) Give **two** processes that happen in the body of person B to cool down their body. (2)

1. hairs will lie flat to trap out heat
 2. sweat will be released from sweat glands coming down the body

Again, learner did not read the question carefully and gave a way to cool the body instead of a process that would happen in the body of a person.

(ii) Give **two** processes that happen in the body of person B to cool down their body. (2)

1. Sweating cools you down.
2. Drinking cold water cools you down.

In part (b) of question 1, a good proportion of learners were able to describe an involuntary response as a response where the person does not have to think about it or that they cannot control.

(b) The processes used to keep the body temperature constant are involuntary responses.

State what is meant by the term **involuntary response**.

(1)

A bodily response or process that one does not need to think of before it is done. The body does it on its own (Total for Question 1 = 4 marks)

In some cases, learners rewrote the stem of the question, this gained no credit. Learners should be taught that no credit is awarded for repeating the stem of the question.

(b) The processes used to keep the body temperature constant are involuntary responses.

State what is meant by the term **involuntary response**.

(1)

Involuntary responses mean it's a response that is not voluntary ~~for~~

(Total for Question 1 = 4 marks)

In question 2(a)(i), learners were asked to draw a line label the nucleus of a neurone, in the majority of cases this was completed with many gaining the mark. In some cases learners did not label the line but this was not necessary to gain the mark.

2 (a) Figure 2 shows a type of neurone.

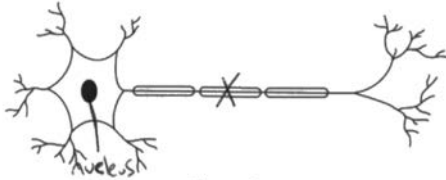


Figure 2

2 (a) Figure 2 shows a type of neurone.

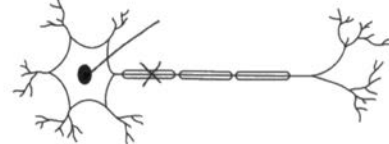


Figure 2

In part (a)(ii) of question 2a, many learners were able to give a function of the nucleus, stating that it controls a cell or contain genetic information or DNA. In some cases, learners stated that the nucleus was the brain of the cell, this was ignored and did not gain credit.

(ii) State the function of the nucleus.

(1)

Nucleus contains genetic information

Question 3(a) learners were asked the definition of two biological terms, heterozygous and phenotype. Learners found this difficult.

This example gained a mark for knowing that heterozygous meant that a genotype contains two different alleles.

3 (a) A genotype can be heterozygous or homozygous.

State what is meant by the term **heterozygous**.

(1)

has 2 different alleles for example Aa

A common misconception seen was that heterozygous meant the genotype was female.

3 (a) A genotype can be heterozygous or homozygous.

State what is meant by the term **heterozygous**.

(1)

Means it can be ~~homozygous~~ heterozygous

Some learners were able to describe what was meant by phenotype as in this

(b) State what is meant by the term **phenotype**.

(1)

phenotype is a characteristic in someone's body

A common answer that gained no credit was that a phenotype is what the parents have in common.

(b) State what is meant by the term **phenotype**.

(1)

phenotype is what the two parents have in common

Learners interacted well with part (c) of question 3, with many being able to apply their knowledge to the question. A good proportion of learners knew that the genetic mutation meant that the black moth was camouflaged or that they blended in. Better learners then linked this to the fact that the black moth would then not be eaten by predators or the fact that the moths would be able to survive to reproduce.

(c) The peppered moth can be either white speckled or black.

The black moth is caused by a genetic mutation.

In areas of high pollution, tree trunks are much darker because of high levels of soot in the atmosphere.

Figure 4 shows both types of moth on a tree trunk in an area with high levels of soot.

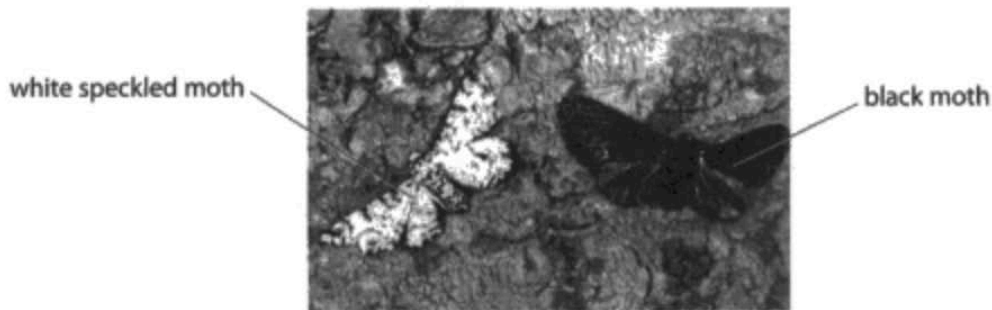


Figure 4

Explain why, in areas with high levels of soot, this genetic mutation is beneficial to black moths.

(2)

in areas with high levels of soot the trees are darker so the black moth will blend in, whereas the white moth will be easily visible. also this means that the black moth has an increased chance at survival and reproduction.

Learners were also to apply their knowledge well in question 3(d) with a good proportion being able to work with the information in the question to draw a correct Punnett square, which gained 3 marks.

The best learners were then able to use this information to explain why all of the pea plants produced were yellow as in this example.

(d) Pea plants can produce either green peas or yellow peas.
 The allele for yellow peas is Y.
 The allele for green peas is y.

The allele for yellow peas is dominant.

A parent pea plant with the genotype YY is crossed with a parent pea plant with the genotype yy.

Explain why all the offspring pea plants produce yellow peas.
 You may use a Punnett square to support your answer.

(4)

	y	Y	<i>parent genotype</i>
y	Yy	Yy	
<i>parent</i>	y	Yy	Yy

This is because we only need one copy of dominant allele yellow (Y) to produce yellow peas. Whereas, we need two copies of recessive allele to produce green peas (yy). (Recessive allele is weaker)

Dominant allele (YY) is stronger than recessive allele (yy). The punnett square shows 100% chances to produce yellow peas. (YY)

(Total for Question 3 = 8 marks)

TOTAL FOR SECTION A = 18 MARKS




The first part of question 4, part a, was generally well answered with the majority of learners being able to link the correct hazard symbol with the hazard that it represents.

In some cases, learners lost marks as they drew more than one line from one hazard symbol to hazards, the incorrect extra line then negated the correct first line.

In this example, the learner scored 2 marks for correctly linking the flammable symbol and the toxic symbol, but lost a mark as they linked the corrosive symbol to corrosive and irritant.

In these type of questions, learners should be taught to draw only one line from each option unless told otherwise.

4 (a) Different substances have different hazard symbols.
 Draw a line from each hazard symbol to its hazard. (3)

hazard symbol	hazard
	<input type="checkbox"/> corrosive
	<input type="checkbox"/> explosive
	<input type="checkbox"/> flammable
	<input type="checkbox"/> harmful to the environment
	<input type="checkbox"/> irritant
	<input type="checkbox"/> oxidising
	<input type="checkbox"/> toxic

The diagram shows three hazard symbols on the left and seven hazard labels in boxes on the right. Lines are drawn from the symbols to the labels: the top symbol (flame) is connected to 'corrosive' and 'irritant'; the middle symbol (test tubes) is connected to 'explosive' and 'toxic'; the bottom symbol (skull and crossbones) is connected to 'toxic'.

Question 4(a)(iii) tested the learners ability to write formula for molecules.

Some learners still struggle with this. Common errors were to write the formula of the atom rather than the molecule or represent the formula incorrectly with a superscript rather than a subscript 2.

(iii) One of the substances could be oxygen.

Give the formula for a molecule of oxygen.

O

(iii) One of the substances could be oxygen.

Give the formula for a molecule of oxygen.

O₂

In other cases, learners were not able to recall the formula of oxygen at all and gave formula off different compounds that contained oxygen.

(iii) One of the substances could be oxygen.

Give the formula for a molecule of oxygen.

(1)

HO₂

The majority of learners performed well in question 5(a) and were able to write the word equation for the reaction between magnesium and hydrochloric acid.

5 Magnesium is a metal.

(a) Magnesium reacts with hydrochloric acid to produce magnesium chloride and hydrogen.

(i) Write the word equation for this reaction.

(1)

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Where learners lost marks, it was often as they did not read the question carefully and tried to write a symbol equation rather than a word equation. whilst fully correct balanced equations were allowed, this much harder skill was often very hard for learners to get correct and they often lost the mark.

Learners should be taught to read the question carefully and if a word equation is asked for not to attempt a symbol equation.

5 Magnesium is a metal.

(a) Magnesium reacts with hydrochloric acid to produce magnesium chloride and hydrogen.

(i) Write the word equation for this reaction.

(1)



A good proportion of learners were able to state one observation that would be seen when a piece of magnesium reacts with hydrochloric acid.

Bubbles was a correct answer that gained the mark.

(iii) A student reacts a piece of magnesium ribbon with hydrochloric acid.

State **one** observation the student would see as the magnesium reacts with the acid.

(1)

Bubbles

Some learners confused burning a piece of magnesium with its reaction with hydrochloric acid and stated that a bright light would be produced. This gained no credit.

(iii) A student reacts a piece of magnesium ribbon with hydrochloric acid.

State **one** observation the student would see as the magnesium reacts with the acid.

(1)

It makes a bright light.

The majority of learners were able to state the positive result of the test for hydrogen using a lit splint. Stating that a squeaky pop would be heard.

(iv) The hydrogen produced can be tested using a lit splint.

Give the positive result of this test.

(1)

You will hear a squeaky pop
meaning a reaction has occurred

In some cases, learners just stated that it would give off a reaction, this was insufficient for credit.

(iv) The hydrogen produced can be tested using a lit splint.

Give the positive result of this test.

(1)

* Give off a reaction.

Question 5 (b) proved more challenging for learners with only the best being able to score full credit for calculating the relative atomic mass of the sample of magnesium.

(b) Magnesium has different isotopes.

A sample of magnesium contains:

- 79% magnesium-24
- 10% magnesium-25
- 11% magnesium-26

Calculate the relative atomic mass of this sample of magnesium.

(2)

$$24 \times 0.79 = 18.96 \quad + \quad 25 \times 0.10 = 2.5 \quad + \quad 26 \times 0.11 = 2.86$$

$$21.46 + 2.86 = \underline{24.32}$$

relative atomic mass of magnesium = 24.32

In some cases, learners were able to carry out the first part of the calculation, but forgot to divide by 100. In this case the learner scored just 1 mark.

(b) Magnesium has different isotopes.

A sample of magnesium contains:

- 79% magnesium-24
- 10% magnesium-25
- 11% magnesium-26

Calculate the relative atomic mass of this sample of magnesium.

(2)

$$(79 \times 24) + (10 \times 25) + (11 \times 26) = 2432$$

relative atomic mass of magnesium = 2432

Question 6 was answered well by a good proportion of learners with a good range of marks seen. Learners were often able to score full marks in a just a few lines.

In this example, the learner has stated that aluminium has 13 electrons, 13 protons and 14 neutrons, they have stated that the protons and neutrons are in the nucleus and drawn a diagram showing the fact that the atom has 13 electrons, in shells arranged in the configuration 2.8.3. There is more than sufficient here for the learner to gain full marks.

6 Figure 6 shows some information about aluminium.

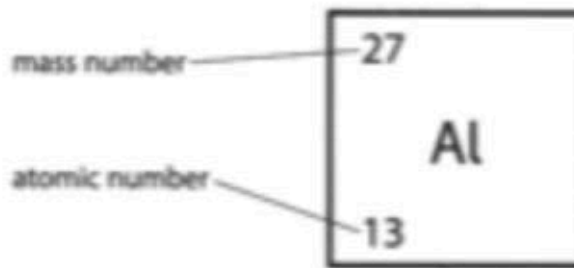


Figure 6

Describe, using the information in Figure 6, the structure of an atom of aluminium.

You may use diagrams to support your answer.



(6)

neutrons

aluminium is a metal it has 13 electrons,
 13 protons and 14 neutrons. The protons and neutrons
 are all inside the nucleus. From the amount we know we
 can tell it's not a charged or metal.

In this example, the learner has drawn the correct electronic configuration to show the 13 electrons in shells in the configuration 2.8.3 to score 3 marks, they also state that the atom has 13 protons to score 4 marks.

6 Figure 6 shows some information about aluminium.

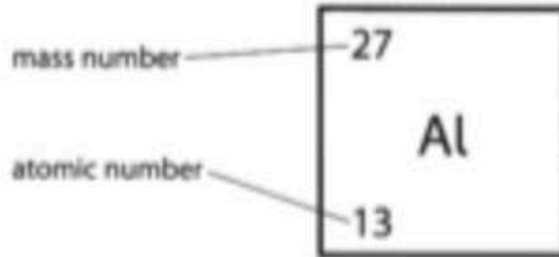


Figure 6

Describe, using the information in Figure 6, the structure of an atom of aluminium.

You may use diagrams to support your answer.

(6)



Aluminium has 13 protons and 13 electrons
and has 3 electrons in the outer shell
therefore it is in group 3

In this last example, the learner scores just 1 mark for stating that the atom has 14 neutrons. The learner has stated some incorrect information, as this did not contradict the fact that the atom has 14 neutrons where the mark was awarded, it was ignored.

6 Figure 6 shows some information about aluminium.

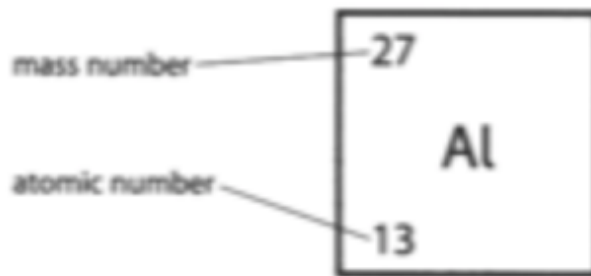


Figure 6

Describe, using the information in Figure 6, the structure of an atom of aluminium.

You may use diagrams to support your answer.

(6)

The mass number minus atomic mass equal to the number of neutron. Aluminium's mass number is 27. It's atomic number is 13. So $27 - 13 = 14$ (no. of neutrons). It is more reactive as it gets down the table. It is in group 2 and it is a non-metal. It is one of the elements to be reacted the most.

Question 7(a)(iii) showed a wave, learners were asked to draw a wave with higher frequency onto the diagram, the majority of learners were able to do this and scored the mark. Often the amplitude of the wave was not the same, but this was not ignored.

(iii) Figure 8 shows a different wave.

Draw, on Figure 8, another wave with a higher frequency than the wave shown. (1)

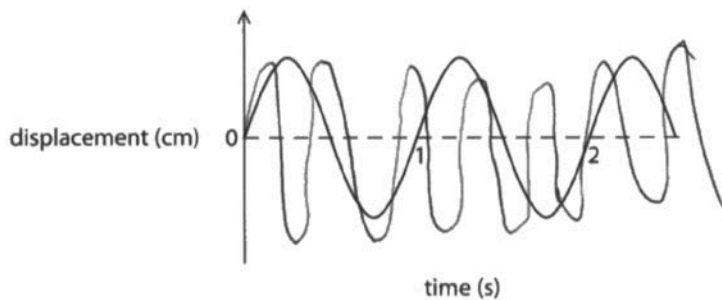


Figure 8

Question 7 (b) asked learners to calculate the efficiency of a digital alarm clock. A good proportion of learners were able to calculate the efficiency correctly to gain both marks, most of these showed their working.

(b) Figure 10 shows the energy transfers in a digital alarm clock.

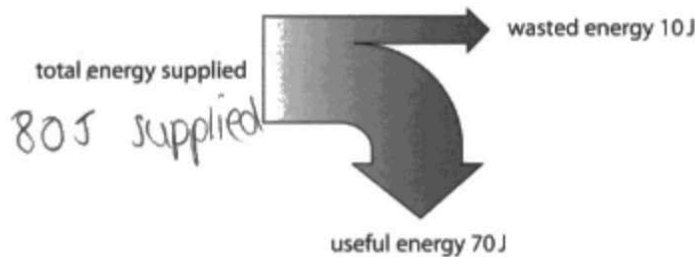


Figure 10

Calculate the efficiency of the digital alarm clock.

(2)

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

$$\frac{70 \text{ J}}{80} \times 100\%$$

efficiency = 87.5 %

Learners found question 8(c) much more difficult to apply their knowledge with few gaining more than 1 mark. In this case, the learner has stated that heat get trapped between the two layers of glass, to gain a mark.

(c) Figure 11 shows a double glazed window.

A double glazed window has two sheets of glass.

Air is trapped between the two sheets of glass.

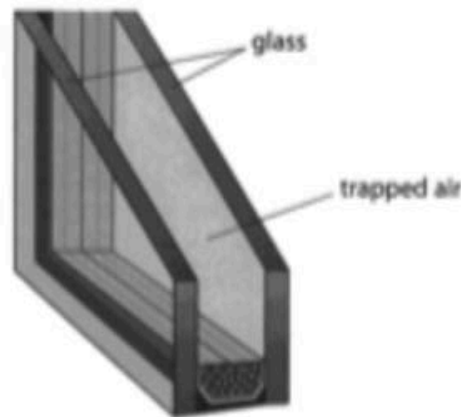


Figure 11

Explain how the double glazed window reduces heat loss from inside a house.

(4)

The double glazed window reduces heat loss from the house as the window is thicker with two bits of glass. Also the heat can get trapped in between the two bits of glass, this keeps the house warmer for longer. Its harder for cold air to get in and hard for hot air to escape.

(Total for Question 8 = 8 marks)

In this case, the learner has labelled the diagram as well as their answer, this was taken into consideration when marking. Between the labelling and the writing, there is the idea of heat being reflected by the outside of the window and the air 'keeping' the heat which was deemed just sufficient for trapping the heat.

(c) Figure 11 shows a double glazed window.
A double glazed window has two sheets of glass.
Air is trapped between the two sheets of glass.

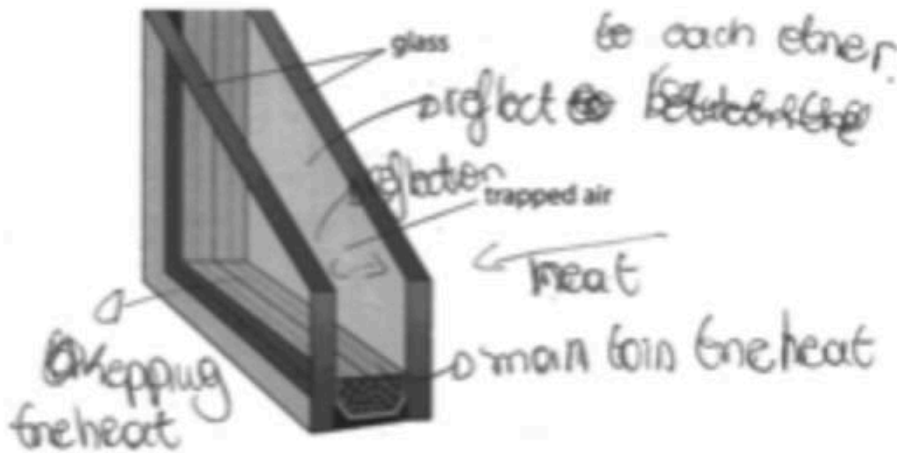


Figure 11

Explain how the double glazed window reduces heat loss from inside a house.

(4)

Double glazed window reduces the heat loss by the reflection of the heat between the two glasses and the trapped air that help to maintain the local warm and reflect the heat from outside by twice.

(Total for Question 8 = 8 marks)

Question 9 tested learners knowledge and understanding of the uses and harmful effects of the electromagnetic spectrum. Learners were asked to discuss two waves from the electromagnetic spectrum.

This example gained 2 marks. The learner has stated that gamma rays cause cancer and that ultraviolet can cause skin cancer. These two basic harmful effects gained the learner full credit at level 1.

9 Figure 12 shows the electromagnetic spectrum.

The electromagnetic spectrum consists of a series of electromagnetic waves arranged in order of increasing frequency.

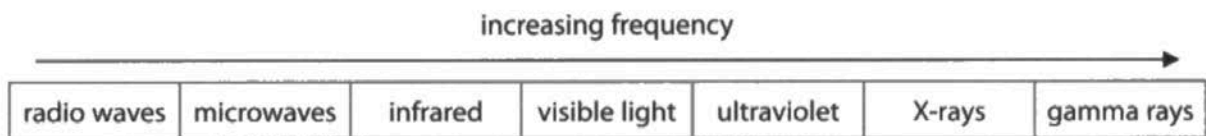


Figure 12

Discuss the uses and harmful effects of **two** of the electromagnetic waves in the spectrum.

(6)

The harmful effects of gamma rays is that too much radiation can harm your body and this can often result in cancer. It can also damage tissue in your body.

The harmful effects in ultraviolet light ~~that is~~ is that if you are exposed to too much of it it can cause skin cancer. It can also cause your skin to go prickly, red and itchy, this is often called prickly heat.

In this next example, the learner has discussed three rather than 2 waves. In cases such as these, the two waves that give the most credit were assessed. Where there were incorrect statements they were ignored as long as they did not contradict correct statements.

In this case the two waves that give the most credit are the gamma and UV. (the microwaves could only get a weak credit).

Each use and harmful effect were linked well, but was not detailed and so therefore a mark of 4 in level 2 was awarded.

9 Figure 12 shows the electromagnetic spectrum.

The electromagnetic spectrum consists of a series of electromagnetic waves arranged in order of increasing frequency.

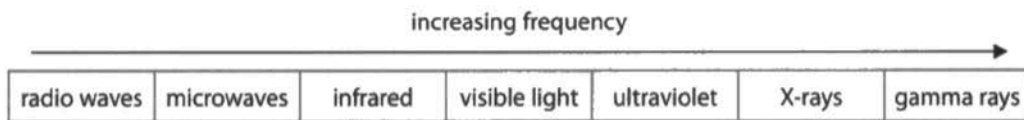


Figure 12

Discuss the uses and harmful effects of **two** of the electromagnetic waves in the spectrum. (6)

Gamma Rays are useful for treating cancer as surges of high energy can be fired to kill cancer cells however they can also damage healthy cells or surrounding tissue.

Ultraviolet has many uses, one common use is for for tanning, it can be used as an indoor tanning solution however if used regularly at high power it also has a risk of ~~creating~~ ^{causing} cancer

microwaves are very useful in many ways, microwaves can be used to heat water in it's industrial form

(Total for Question 9 = 6 marks)

This last example gained a mark of 5 in level 3. The learner has discussed microwaves and gamma rays. The uses and harmful effects for the gamma rays are good and would gain level 2 alone. Whilst the information on the microwaves brought the answer into level 3, the discussion of the harmful effects of the microwaves are very weak and detracts a little from the overall answer so a mark of 5 rather than 6 was awarded.

9 Figure 12 shows the electromagnetic spectrum.

The electromagnetic spectrum consists of a series of electromagnetic waves arranged in order of increasing frequency.

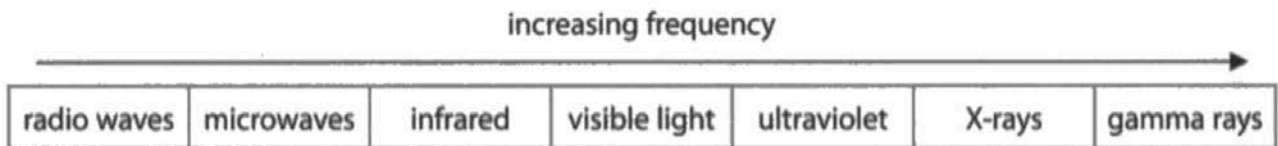


Figure 12

Discuss the uses and harmful effects of **two** of the electromagnetic waves in the spectrum. (6)

Uses of microwaves-

- broadcasting + transmitting
- Mobile phone signals
- weather forecasting
- satellite signals

Uses of gamma rays

- used to treat cancer
- used to detect cancer

Disadvantages of Microwaves

- causes skin burns
- Damages your eyes

Disadvantages of IR:

- causes cell damage
- cell mutation
- Damages your eyes

Summary

Based on their performance on this paper

Learners should:

- practice applying the science that they have to new and different situations and context
- practice calculations from the unit

Centres should:

- continue work on helping learners understand what is meant by different command words such as explain, describe, state and give and reading questions carefully

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