**Week 3 Learning Check**
**Physics Foundation**

Name: ____________________

Class: ____________________

Date: ____________________

| | |
|---|---|
| Time: | **30 minutes** |
| Marks: | **31 marks** |
| Comments: | |

**Q1.**

(a) A washing machine washes dirty clothes and then spins the clothes to remove some of the water.

(i) Use the correct words from the box to complete the sentence.

| chemical | electrical | kinetic | sound |
|---|---|---|---|

When the washing machine spins the clothes, ____________________

energy is transferred into useful ____________________ energy.

**(2)**

(ii) Name **one** type of energy the washing machine wastes when spinning the clothes.

___________________________________________________________

**(1)**

(iii) What eventually happens to all the wasted energy?

Tick **one** box.

The wasted energy is transferred to the clothes. ☐

The wasted energy is transferred to the surroundings. ☐

The wasted energy is trapped and is re-used. ☐

**(1)**

(b) The table shows information about two different washing machines, **A** and **B**.

| | **Washing machine A** | **Washing machine B** |
|---|---|---|
| Cost to buy | £269 | £249 |
| Maximum wash load | 8 kg | 7 kg |
| Energy transferred in one wash cycle | 0.7 kWh | 1.2 kWh |
| Water used in one wash cycle | 48 litres | 50 litres |

Use the information in the table to give **one** advantage and **one** disadvantage of washing machine **A** compared with washing machine **B**.

Advantage ___________________________________________________________

___________________________________________________________

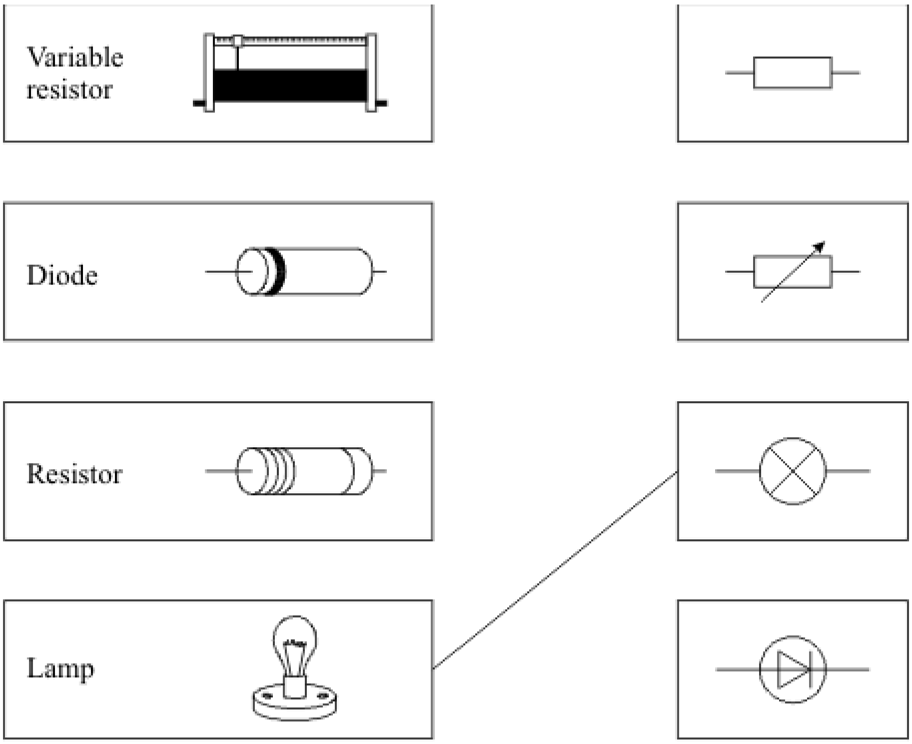
Disadvantage ______________________________________________

______________________________________________

**(2)**
**(Total 6 marks)**

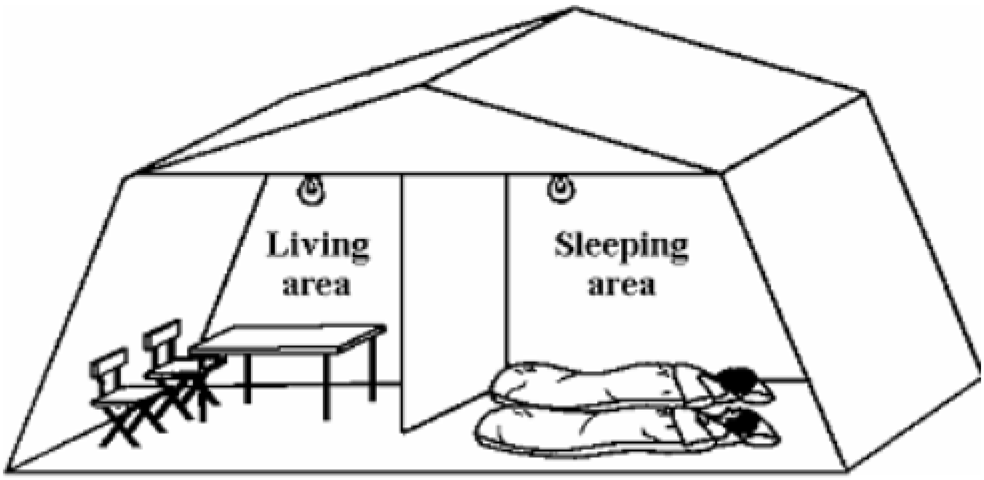
## Q2.

(a) Draw lines to join the picture to the correct circuit symbol. The lamp has been done for you.

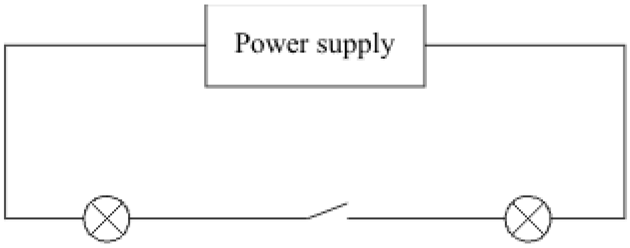



**(2)**

(b) A family tent is to be fitted with a simple lighting circuit.




The diagram shows the first circuit used.




(i) Are the lamps connected in series or in parallel?

______________________________________________________________

**(1)**

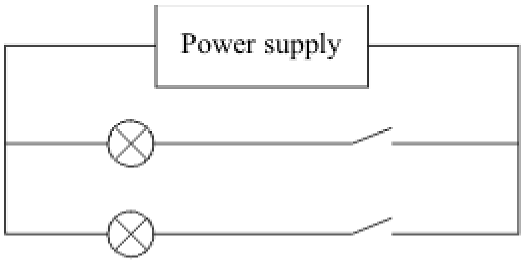
(ii) This is not a good circuit for using in the tent. Why?

______________________________________________________________

______________________________________________________________

**(1)**

The diagram shows the second circuit used.




(iii) Give **two** reasons why this circuit is better than the first circuit.

1. ______________________________________________________________

______________________________________________________________

2. ______________________________________________________________

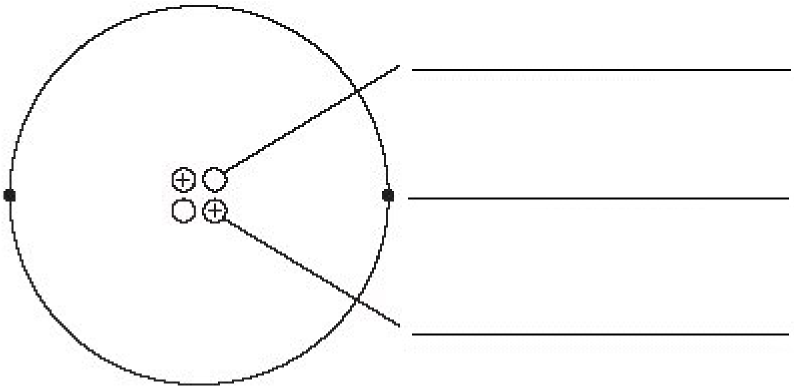
______________________________________________________________

**(2)**

**(Total 6 marks)**

## Q3.

The diagram shows a helium atom.



(a) (i) Use the words in the box to label the diagram.

| electron | neutron | proton |
|---|---|---|

**(2)**

(ii) An alpha particle is the same as the nucleus of a helium atom.

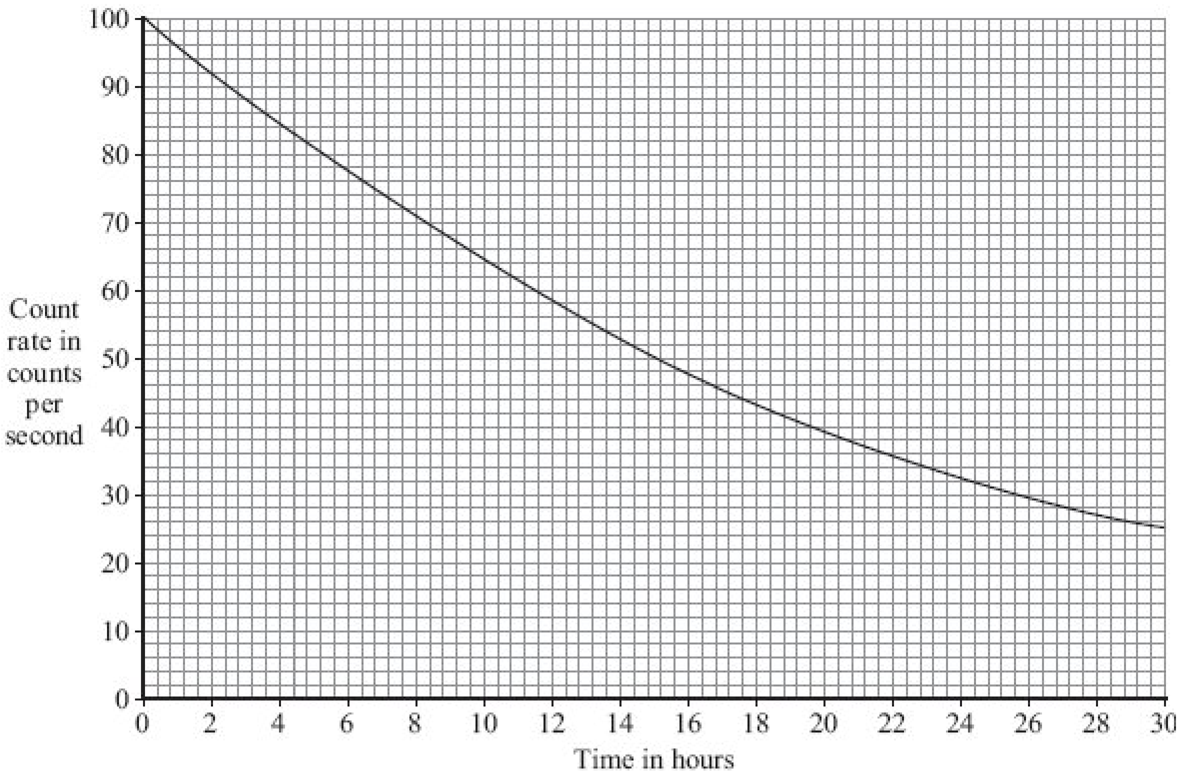
How is an alpha particle different from a helium atom?

______________________________________________

______________________________________________

**(1)**

(b) The graph shows how the count rate from a sample of radioactive sodium-24 changes with time.




(i) How many hours does it take for the count rate to fall from 100 counts per second to 50 counts per second?

Time = _______________ hours

**(1)**

(ii) What is the half-life of sodium-24?

Half-life = _______________ hours

**(1)**

(c) A smoke detector contains a small amount of americium-241.

Americium-241 is a radioactive substance which emits alpha particles. It has a half-life of 432 years.

(i) Which **one** of the following statements gives a reason why the americium-241 inside the smoke detector will **not** need replacing?

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

| | |
|---|---|
| The alpha particles have a low energy. | ☐ |
| People replace smoke detectors every few years. | ☐ |
| Americium-241 has a long half-life. | ☐ |

**(1)**

(ii) The diagram shows the label on the back of the smoke detector.


Why do people need to know that the smoke detector contains a radioactive material?

___________________________________________________________________

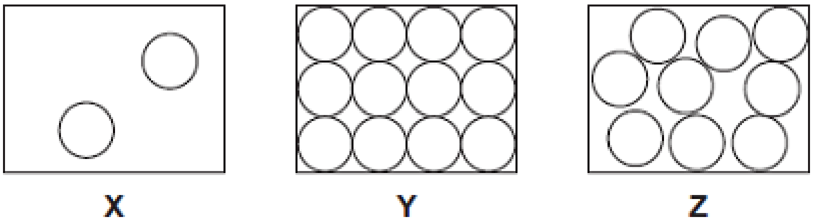
___________________________________________________________________

**(1)**

**(Total 7 marks)**

## Q4.

(a) The diagrams, **X**, **Y** and **Z**, show how the particles are arranged in the three states of matter.




(i) Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a liquid?

Write the correct answer in the box. ☐

**(1)**

(ii) Which **one** of the diagrams, **X**, **Y** or **Z**, shows the arrangement of particles in a gas?

Write the correct answer in the box. ☐

**(1)**

(b) Draw a ring around the correct answer in each box to complete each sentence.

(i) In a gas, the particles are

| |
|---|
| vibrating in fixed positions. |
| moving randomly. |
| not moving. |

**(1)**

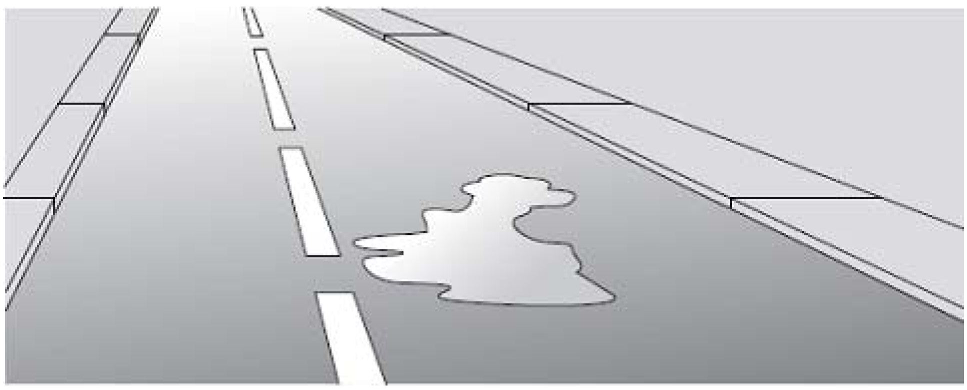
(ii) In a solid, the forces between the particles are

| |
|---|
| stronger than |
| equal to |
| weaker than |

the forces between the particles in a liquid.

**(1)**

(c) The picture shows a puddle of water in a road, after a rain shower.



(i) During the day, the puddle of water dries up and disappears. This happens because the water particles move from the puddle into the air.

What process causes water particles to move from the puddle into the air?

Draw a ring around the correct answer.

**condensation** **evaporation** **radiation**

**(1)**

(ii) Describe **one** change in the weather which would cause the puddle of water to dry up faster.

___

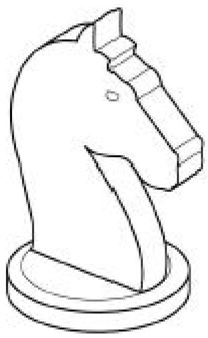
___

**(1)**
**(Total 6 marks)**

## Q5.

A student wanted to determine the density of the irregular shaped object shown in **Figure 1**

**Figure 1**



Plan an experiment that would allow the student to determine the density of the object.

___

___

___

___

___

___

___

___

___

**(6)**
**(Total 6 marks)**

# Mark schemes

## Q1.

(a) (i) electrical

*answers must be in the correct order*

1

kinetic

1

(ii) any **one** from:

- thermal (energy)
- sound (energy).

*allow "heat" (energy)*

1

(iii) The wasted energy is transferred to the surroundings

1

(b) *advantage of A*:

*answers must be comparative*

1

any **one** from:

- bigger wash load
- uses less energy
  *allow uses less electricity*
- uses less water.

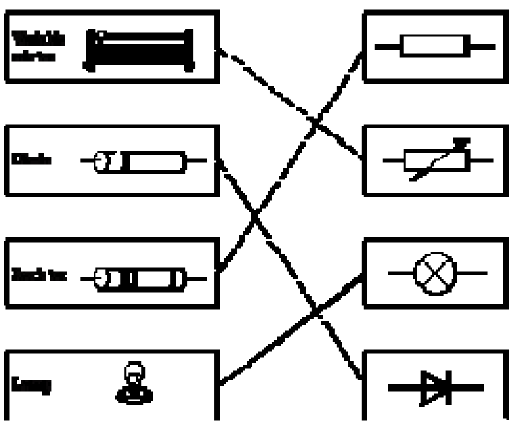
*disadvantage of A*:
higher cost (to buy)

1

**[6]**

## Q2.

(a) all 3 lines drawn correctly



*(1only correct, 1 mark)*
*deduct one mark if more than one line from or to a single box*

2

(b) (i) series

1

(ii) any **one** from:

- both lamps **or** lights must be on together
- if one blows, the other goes out
- switch controls both bulbs

  *do **not** accept bulbs dimmer*

1

(iii) any **two** from

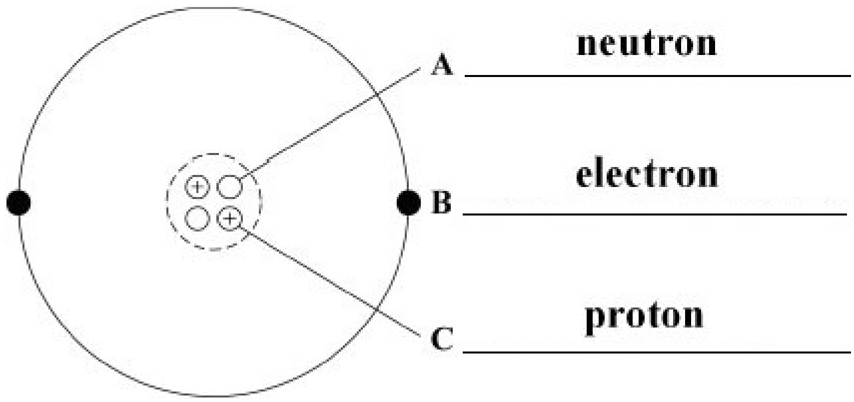
- each lamp **or** light can be switched on independently
- if one lamp blows the other stays on
- switching the second lamp on does not affect brightness of first **or** bulbs brighter (than in first circuit) or energy explanation

2

**[6]**

## Q3.

(a) (i)




*all 3 labels correct*

*allow **1** mark for 1 correct label*

2

(ii) has no electrons

*it = alpha*

*allow alpha has a positive(charge)*
*allow a helium (atom) has no (charge)*

*do **not** accept general properties of alpha*
*do **not** accept general answers in terms of size / density / mass etc*

1

(b) (i) 15 (hours)

*accept any answer between 14.8 and 15.2 inclusive*

1

(ii) 15 (hours) or their (b) (i)

1

(c) (i) americium-241 has a long half life

1

(ii) any **one** from:

- alpha (particles) are harmful to …
  *accept radiation / radioactive material is harmful to …*
  *accept specific example of harm*
  *eg can cause cancer*
  *accept radiation is poisonous if ingested / inhaled*
  *do **not** accept it is poisonous / in case of leakage*
- so they dispose of it safely / appropriately
- so they don't break it open / open it
  *accept do **not** touch the radioactive source*
- so they can make a choice about having a radioactive source (in the house)
  *it = radioactive material*

1

**[7]**

## Q4.

(a) (i) Z

1

(ii) X

1

(b) (i) moving randomly

1

(ii) stronger than

1

(c) (i) evaporation

1

(ii) any **one** from:

- becomes windy
- temperature increases
  *accept (becomes) sunny*
  *"the sun" alone is insufficient*
- less humid

1

**[6]**

## Q5.

(a) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

**Level 2:** The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

**Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

**No relevant content**

0

**Indicative content**

- measure mass
- use a top pan balance or scales

- part fill a measuring cylinder with water
- measure initial volume
- place object in water
- measure final volume
- volume of object = final volume − initial volume

- fill a displacement / eureka can with water
- water level with spout
- place object in water
- collect displaced water
- measuring cylinder used to determine volume of displaced water

- use of:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

**[6]**

Examiner reports

## Q1.

(a) (i) Some students gave the correct answers, but in the wrong order. Chemical energy was sometimes given for the starting energy and sound for the useful energy.

(ii) Sound was the most common correct answer given for the energy wasted by the washing machine. Thermal energy was rarely mentioned. Quite a lot of students thought that electrical energy was wasted.

(iii) Three quarters of students identified that the wasted energy is transferred to the surroundings.

(b) Comparative statements were needed, so simply quoting figures did not gain a mark. Some students misunderstood the energy transferred per cycle and thought it was either energy wasted, or that using less energy meant that the machine was not as good.

## Q2.

Parts (a) and (b)(i) were generally answered well, as was part (b)(ii), although many candidates said that if one lamp 'blew' so would the other. Part (b)(iii) was well understood.

## Q3.

(a) (i) Many of the candidates were able to identify correctly all three particles in the helium atom. The most common mistake was to confuse the neutron with the proton.

(ii) This was a very poorly answered question, with very few candidates gaining credit. The most common response was to talk about the penetrating powers of the alpha particle, or to try to compare their sizes.

(b) (i) Most candidates were able to obtain the correct answer of 15 hours. Some candidates however, had shown, by drawing on the graph, that they knew *how* to obtain the correct figure, but had then failed to interpret the scale on the *x*-axis correctly. Some candidates were careless in drawing a horizontal line across from 50 and so gave the wrong value.

(ii) The majority of candidates failed to appreciate that they had actually just obtained the figure for the half-life in the answer to part (b)(i). Many candidates chose a figure that was either double or half of their answer to the previous part.

(c) (i) Most candidates realised that americium was chosen because it has a long half-life.

(ii) Just under half of the candidates were able to score the mark for this question, either by stating one of the dangers of radioactive material or by saying that it would help the user to dispose of the product in a safe manner. Some candidates gave answers that were too vague to earn a mark, such as 'radioactivity is bad for you'.

## Q4.

(a) (i) Nearly all students answered this correctly.

(ii) Nearly all students answered this correctly.

(b) (i) Nearly all students answered this correctly.

(ii) Nearly all students answered this correctly.

(c) (i) The majority of students correcty chose evaporation.

(ii) Most students knew that if the weather became warmer or more windy the puddle of water would evaporate faster. A few students were unspecific and simply wrote “temperature” or “the Sun”.

## Q5.

**Foundation**

(a) This levels of response question had three tiers. When students are asked to describe a plan or method, their answer must contain all of the key steps in a logical sequence and lead to a valid outcome. This practical is one of the required practicals on the specification, so a displacement technique should have been described by students but this was not always the case. To achieve a level 3 response students should state:

- the variables are to be measured
- the measuring instruments to be used
- how the measurement is to be made
- how the gathered data is to be processed.

Some students described the method without stating that the volume of the displaced water would equal the volume of the object. Measuring cylinders did not always get a mention with a significant number assuming that beakers would give an accurate enough measurement. Whilst some described how the object needed lowering carefully into the water to avoid splashes and excess spillage, others would have obtained very inaccurate measurements by collecting what overflowed from buckets and bowls. Some went no further than the volume measurement which was occasionally described as the density. ‘Weighing’ the object to get the mass, often without a mention of a balance or scales, was common.

There were some methods described which would not work, such as measuring dimensions, timing falls, or checking for sinking and floating. Some students described melting, smashing and breaking the object.

Very few students we able to write an answer which would lead to a valid outcome, with key steps identified and logically sequenced. Just over a third of students scored zero.

(b) 57% of the students scored at least 2 marks with 39% gaining full marks but 17% did not score on this question and 5% made no attempt. There were some good answers putting 0, 250, 500 etc. on the y axis and accurate plotting of the three bars required.
Some students put too many values on the *y*-axis making it difficult to judge if they were correct and giving more chance of getting one or more of the values wrong.

(c) Only a small minority of students scored both marks and over two-thirds scored zero. It was possible to get the correct answer of 80 in a variety of ways and students did so but the concept of uncertainty seemed to be poorly understood.

**Higher**

(a) This levels of response question had three tiers. When students are asked to describe a plan or method, their answer must contain all of the key steps in a logical sequence and lead to a valid outcome. This practical is one of the Required Practical Activities on the specification, so a displacement technique should have been described but this was not always the case. To achieve a level 3 response students should state:

- the variables to be measured
- the measuring instruments to be used
- how the measurement is to be made
- how the data gathered is to be processed.

Some students described the method without stating that the volume of the displaced water would equal the volume of the object. Measuring cylinders did not always get a mention with a significant number assuming that beakers would give an accurate enough measurement. Whilst some described how the object needed lowering carefully into the water to avoid splashes and excess spillage, others would have obtained very inaccurate measurements by collecting what overflowed from buckets and bowls. Some went no further than the volume measurement which was occasionally described as the density. 'Weighing' the object to get the mass, often without a mention of a balance or scales, was common.

There were some methods described which would not work, such as measuring dimensions, timing falls, or checking for sinking and floating. Some students described melting, smashing and breaking the object.

25% of students we able to write an answer which would lead to a valid outcome with key steps identified and logically sequenced and were judged to have written a level 3 response. A further quarter of students achieved a level 2 mark. Level 1 was awarded to 30%. A significant minority scored zero or did not attempt the question.

(b) 67% of the students scored full marks. There were good answers putting 0, 250, 500 etc. on the *y*-axis and accurate plotting of the three bars required.

Some students tried to put far too many values on the *y*-axis making it difficult to judge if they were correct and giving more of a chance of getting one or more of the values wrong.

(c) Only a fifth of students gained both marks and just over half scored zero. It was possible to get the correct answer of 80 in a variety of ways, and students did, but the concept of uncertainty seemed to be poorly understood.