Week 3 Learning Check
Physics Higher

Name: _____

Class: _____

Date: _____

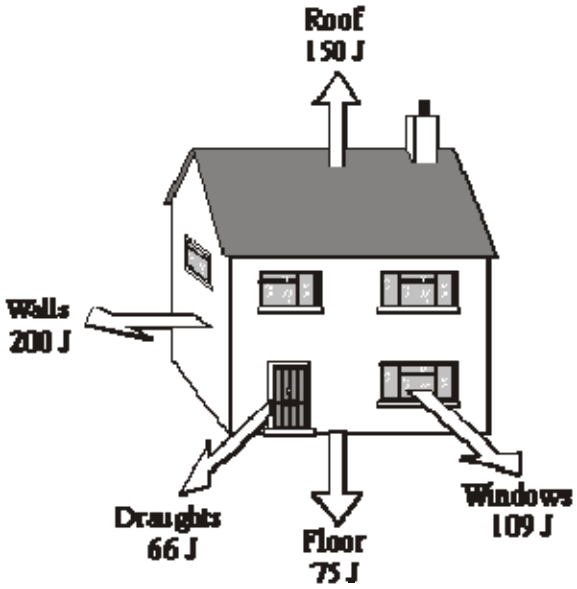
Time: **30 minutes**

Marks: **29 marks**

Comments:

Q1.

(a) The diagram shows how much heat is lost each second from different parts of an uninsulated house.



(i) Each year, the house costs £760 to heat.

How much money is being wasted because of heat lost through the roof?

Show clearly how you work out your answer.

_____

_____

(2)

(ii) Insulating the loft would cut the heat lost through the roof by 50 %.

The loft insulation has a payback time of $1\frac{1}{2}$ years.

How much did the loft insulation cost to buy?

_____

Cost of loft insulation = £ _____

(1)

(b) What happens to the wasted energy?

_____

_____

(1)

(Total 4 marks)

Q2.

Density can be explained using the particle model.

(a) What is the unit of density (ρ)?

Tick **one** box.

joules, J ☐

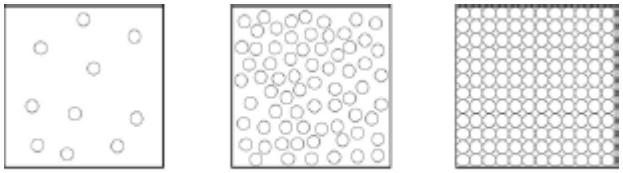
joules per kilogram, J / kg ☐

kilograms, kg ☐

kilograms per metre cubed, kg / m^3 ☐

(1)

(b) The figure below shows particles of the same substance in three states of matter.



Use the figure above to explain why the solid has the highest density.

_____

_____

_____

_____

(2)

(c) Complete the sentences.

Use answers from the box.

downwards	**kinetic**	**nuclear**	**potential**	**randomly**	**slowly**

The particles in a gas are constantly moving.

The particles move _____

When the temperature of the particles in a gas is increased

the particles have more _____energy .

(2)

(d) A gas is put into a closed container.

The container and the gas inside it are heated.

What will happen to the pressure inside the container?

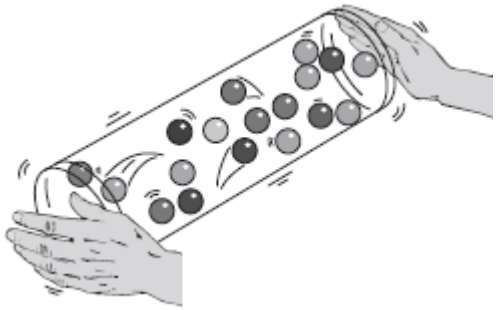
_____

(1)

(Total 6 marks)

Q3.

A student shakes a tube containing small balls to model the movement of particles in a gas.



(a) Why is this a good model for the movement of particles in a gas?

Tick (✓) **two** boxes.

The balls move slowly.	☐
The balls are far apart from each other.	☐
The balls are different colours.	☐
The balls move randomly.	☐

(2)

(b) For a given material, in which state of matter:

are the particles in a regular arrangement?

_____

do the particles have the most kinetic energy?

_____

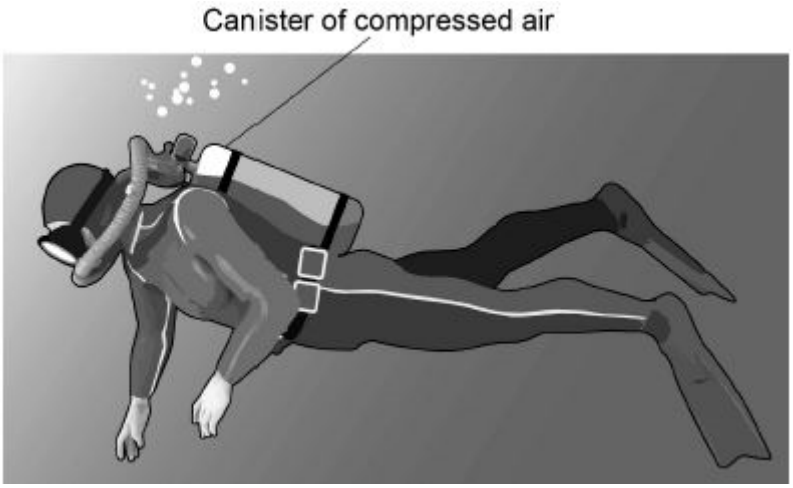
(2)

(Total 4 marks)

Q4.

Figure 1 shows a diver.

Figure 1



(a) Which two sentences describe the movement of the air particles in the canister?

Tick **two** boxes.

They vibrate about a fixed position. ☐

They move in random directions. ☐

The motion of all the particles is predictable. ☐

They move with a range of different speeds. ☐

They move in circular paths. ☐

(2)

(b) The temperature of the air inside the canister increases.

What happens to the movement of the air particles?

_____

(1)

(c) It could be dangerous if the temperature of the air inside the canister increased by a large amount.

Explain why.

_____

_____

_____

_____

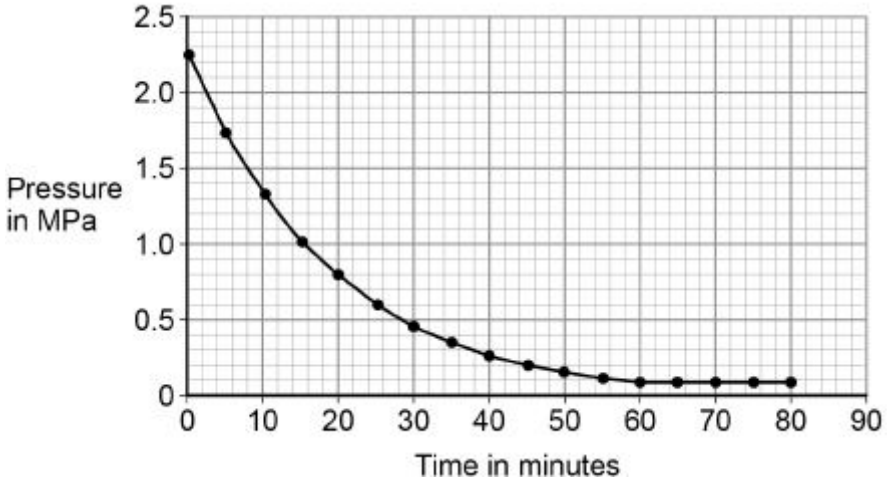
(2)

A canister of air was tested to find out how the pressure changed when it was used by a diver.

- Air was allowed to escape from the canister.
- The pressure of the air in the canister was recorded every 5 minutes for 80 minutes.

Figure 2 shows the results.

Figure 2



(d) Estimate the atmospheric pressure.

Use **Figure 2**

Atmospheric pressure = _____ MPa

(1)

(e) Divers can safely stay underwater until the pressure of the air in the canister has reduced to 25% of its original value.

Determine the maximum time the diver can safely stay underwater.

Use **Figure 2**

_____

_____

Time = _____ minutes

(3)

(f) What happens to the volume of the air when it is released from the canister?

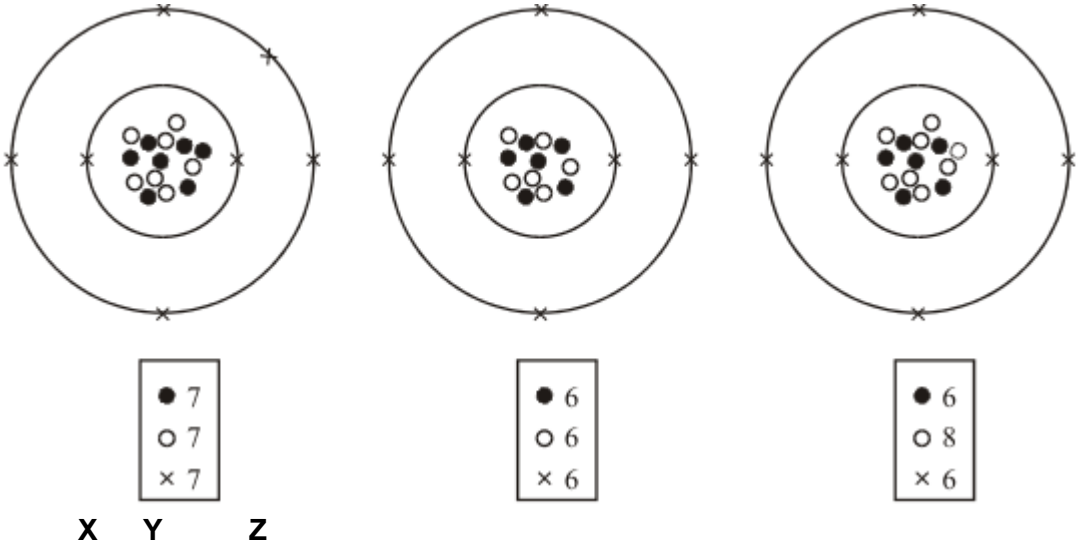
_____

(1)

(Total 10 marks)

Q5.

(a) The diagrams represent three atoms **X**, **Y** and **Z**.



Which **two** of the atoms are from the same element?

_____

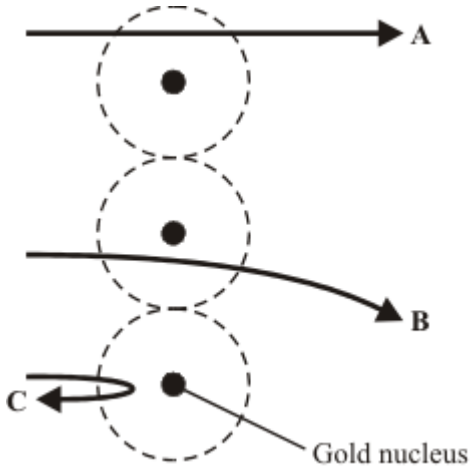
Give a reason for your answer.

_____

_____

(2)

(b) In the early part of the 20th century some scientists investigated the paths taken by positively charged alpha particles into and out of a very thin piece of gold foil. The diagram shows the paths of three alpha particles.



Explain the different paths **A**, **B** and **C** of the alpha particles.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Q1.

(a) (i) £190

nb mention idea of cost per J in £ will come to an approx figure full credit given

*allow **1** mark for showing that the energy loss through the roof is ¼ of the total energy loss ie 150 / 600*

2

(ii) £142.50

allow ecf 50 % of their (a)(i) × 1.5 ie their (a)(i) × 0.75

1

(b) transferred to surroundings / atmosphere

or becomes spread out

1

[4]

Q2.

(a) kilograms per metre cubed, kg / m^3

1

(b) (solid has) more particles

allow atoms for particles

1

in the same volume **or** in a given volume

allow description of a given area

1

(c) randomly

this order only

1

kinetic

1

(d) (pressure) rises

1

[6]

Q3.

(a) balls are far apart from each other

1

balls move randomly

1

(b) solid

1

gas

1

[4]

Q4.

(a) they move in random directions

1

they move with a range of different speeds

1

(b) the (mean) speed of the particles would increase

allow kinetic energy increases

1

(c) (if the temperature increases) the pressure increases

allow an explanation in terms of large pressure difference

1

so it could explode

1

(d) p = 0.1 (MPa)

1

(e) $p = 2.25 \times \left(\frac{25}{100}\right)$

allow any correct method of determining 25% of 2.25
allow use of 2.2−2.3

1

p = 0.56

allow 0.55−0.575

1

t = 27 (minutes)

allow 26−28 minutes
allow correct value of t using their calculated value of p

1

*an answer of 27 scores **3** marks*

(f) (the volume of the air) increases

1

[10]

Q5.

(a) **Y** and **Z**

1

they have the same number of protons **or** same atomic number

*accept they have the same number of electrons **or** same number of protons **and** electrons*

allow only different in number of neutrons N.B. independent marks

1

(b) **Quality of written communication**

*for correct use of terms underlined in B **or** C*

Q ✔ Q ✘

1

A – alpha particle passes straight through the empty space of the atom
or it is a long way from the nucleus

*describes 3 tracks correctly for **2** marks*
*describes 2 or 1 track correctly for **1** mark*

B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u>

C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards

*do **not** accept hits the nucleus*
*do **not** accept answers referring to refraction*
*do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion*

mention of difference in charge on nucleus negates that track

max 2

[5]

Q1.

(a) (i) Whilst quite a lot of candidates were able to work out that 25 % of the energy was lost through the roof, many failed to realise that they needed to work out 25 % of the cost.

(ii) This calculation proved rather difficult for many candidates.

Overall in part (a) there were a surprisingly large number of minor arithmetical errors and several answers which candidates should have recognised as unrealistically small or large eg in part (ii) answers such as £1 or £200,000.

(b) Candidates scored well with most gaining credit.

Q3.

(a) Most students could recognise how the model represented the movement of particles in a gas. Some had not followed the instructions and ticked more than two boxes.

(b) Many students misinterpreted the question stem, or did not understand what a state of matter is, and answered yes or no. Some gave air instead of gas.

Q4.

(a) Over 90% of students scored at least 1 mark and 73 % scored 2 marks.

(b) 69% of students answered correctly. Many students who weren't awarded the mark probably intended to say that the speed increased, but simply offered 'increased' as their response, which is ambiguous. Many incorrect responses referred to increased vibration or faster vibration in the air.

(c) A little over 70% of students recognised that the canister was in danger of exploding/bursting. 33% went on to say that the increase in pressure was the cause. Of the students that failed to score any marks, most just made simple statements such as 'the diver will not be able to breathe'.

(d) Only 31% of students deduced that the pressure would stop dropping when the pressure inside the can was the same as the atmospheric pressure.

(e) 32% of students scored all three marks on the question. 27% were able to calculate the final pressure but then read the value from the graph incorrectly.

A number of students incorrectly calculated 75% of the initial pressure and then read the value off the graph correctly as t = 6, and scored one mark.

Q5.

Foundation Tier

(a) The two atoms, which were isotopes, were successfully identified by the majority of candidates, with an appropriate reason stated.

(b) Too many candidates simply described the tracks rather than explain why the alpha

particle would take each of the paths shown. To score maximum marks, explanations were needed using scientific words to indicate that candidates were applying their scientific knowledge that repulsion will occur between similarly charged particles.

Higher Tier

(a) The two atoms, which were isotopes, were successfully identified by a majority of candidates with an appropriate reason stated.

(b) Too many candidates simply described the tracks rather than explain why the alpha particle would take each of the paths shown. To score maximum marks, explanations were needed using scientific words to indicate that candidates were applying their scientific knowledge that repulsion will occur between similarly charged particles.