ST EDWARD'S OXFORD

14+ Entrance Assessment

**2016**

Science

1 hour

Candidate Name: ……………………………….

THE PERIODIC TABLE

Group

1	2											3	4	5	6	7	0
																	4 He Helium 2

Period

1

| 1
H
Hydrogen
1 |

| 7
Li
Lithium
3 | 9
Be
Beryllium
4 | | | | | | | | | | | 11
B
Boron
5 | 12
C
Carbon
6 | 14
N
Nitrogen
7 | 16
O
Oxygen
8 | 19
F
Fluorine
9 | 20
Ne
Neon
10 |

2

| 23
Na
Sodium
11 | 24
Mg
Magnesium
12 | | | | | | | | | | | 27
Al
Aluminium
13 | 28
Si
Silicon
14 | 31
P
Phosphorus
15 | 32
S
Sulphur
16 | 35.5
Cl
Chlorine
17 | 40
Ar
Argon
18 |

3

| 39
K
Potassium
19 | 40
Ca
Calcium
20 | 45
Sc
Scandium
21 | 48
Ti
Titanium
22 | 51
V
Vanadium
23 | 52
Cr
Chromium
24 | 55
Mn
Manganese
25 | 56
Fe
Iron
26 | 59
Co
Cobalt
27 | 59
Ni
Nickel
28 | 63.5
Cu
Copper
29 | 65
Zn
Zinc
30 | 70
Ga
Gallium
31 | 73
Ge
Germanium
32 | 75
As
Arsenic
33 | 79
Se
Selenium
34 | 80
Br
Bromine
35 | 84
Kr
Krypton
36 |

4

| 86
Rb
Rubidium
37 | 88
Sr
Strontium
38 | 89
Y
Yttrium
39 | 91
Zr
Zirconium
40 | 93
Nb
Niobium
41 | 96
Mo
Molybdenum
42 | 99
Tc
Technetium
43 | 101
Ru
Ruthenium
44 | 103
Rh
Rhodium
45 | 106
Pd
Palladium
46 | 108
Ag
Silver
47 | 112
Cd
Cadmium
48 | 115
In
Indium
49 | 119
Sn
Tin
50 | 122
Sb
Antimony
51 | 128
Te
Tellurium
52 | 127
I
Iodine
53 | 131
Xe
Xenon
54 |

5

| 133
Cs
Caesium
55 | 137
Ba
Barium
56 | 139
La
Lanthanum
57 | 179
Hf
Hafnium
72 | 181
Ta
Tantalum
73 | 184
W
Tungsten
74 | 186
Re
Rhenium
75 | 190
Os
Osmium
76 | 192
Ir
Iridium
77 | 195
Pt
Platinum
78 | 197
Au
Gold
79 | 201
Hg
Mercury
80 | 204
Tl
Thallium
81 | 207
Pb
Lead
82 | 209
Bi
Bismuth
83 | 210
Po
Polonium
84 | 210
At
Astatine
85 | 222
Rn
Radon
86 |

6

| 223
Fr
Francium
87 | 226
Ra
Radium
88 | 227
Ac
Actinium
89 |

7

Key

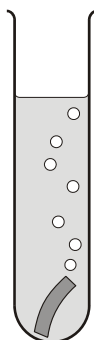| Relative atomic mass |
| Symbol |
| Name |
| Atomic number |

1. (a) Ruth put a piece of a different metal in each of four test tubes.
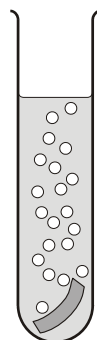
She poured 10 cm^3 of hydrochloric acid onto each metal.
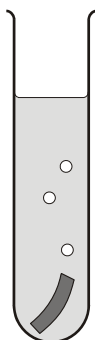
iron
+
hydrochloric acid

zinc
+
hydrochloric acid

magnesium
+
hydrochloric acid

copper
+
hydrochloric acid

Look at the diagrams above.

(i) How do these show if a metal reacts with the acid?

....

1 mark

(ii) **On the lines below**, put the **four** metals in the order of how strongly they react with the acid.

most reactive ....

....

....

least reactive ....

1 mark

(b)   Choose the name of a metal from the box below to answer each question.

| copper   iron   magnesium   zinc |

(i)   Which metal from the box is used for electrical wires?

       ....

1 mark

(ii)   Which metal from the box goes rusty?

       ....

1 mark
maximum 4 marks

2. An alloy is a mixture of elements.
The table shows the mass of each element present in 100 g of five different alloys,
bronze, solder, steel, stainless steel and **brass.**

alloy	mass of each element in 100 g of alloy							
	lead (g)	tin (g)	copper (g)	zinc (g)	carbon (g)	iron (g)	chromium (g)	nickel (g)
bronze		4	95	1				
solder	62	38						
steel					1	99		
stainless steel						70	20	10
brass			67	33				

(a) Which **alloy** in the table above contains an element which is a non-metal?

....

1 mark

(b) Which **two alloys** in the table contain only **two metals**?

.... and ....

1 mark

(c) Another alloy called nichrome contains only the elements chromium and nickel.
100 g of nichrome contains 20 g of chromium.

How much nickel does it contain?

.... g

1 mark

(d)   Before 1992, two-pence coins were made of bronze.
        Steel rusts but bronze does **not** rust.

    (i)   Why does bronze **not** rust?
                Use information in the table above to help you.

                ....

                ....

1 mark

    (ii)   Rusting requires water and a gas from the air.
                Give the name of this gas.

                ....

1 mark

maximum 5 marks

3. Two pupils heated some copper carbonate in a crucible. They recorded the mass of the crucible and contents before and after heating.
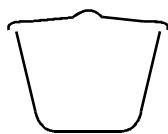
empty crucible   crucible and   crucible and
                        copper carbonate   copper oxide
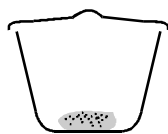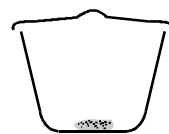
mass = 50.00 g   mass = 51.24 g   mass = 50.80 g

The word equation for this reaction is:

copper carbonate   copper oxide + carbon dioxide

(i) What mass of carbon dioxide is given off in this reaction?
Give the unit.

....

1 mark

(ii) What is the name of this type of chemical reaction?
Tick the correct box.

combustion   [ ]

oxidation   [ ]

reduction   [ ]

thermal decomposition   [ ]

1 mark

(b)   The pupils then heated some magnesium in another crucible. They worked
      carefully and did not lose any of the magnesium oxide which formed.
      They recorded the mass of the crucible and contents before and after heating.
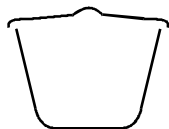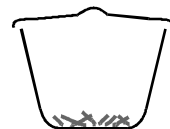
empty crucible	crucible and magnesium	crucible and magnesium oxide
mass = 50.00 g	mass = 50.12 g	mass = 50.20 g

(i)   Write a word equation for the reaction.

       ....

                                                                          1 mark

(ii)   Why does the mass of the contents of the crucible increase in this
       reaction?

       ....

       ....

                                                                          1 mark

(iii) What is this type of chemical reaction called?

       ....

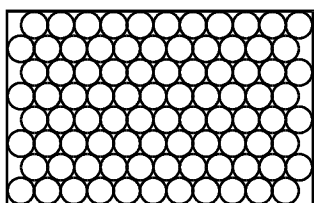   1 mark
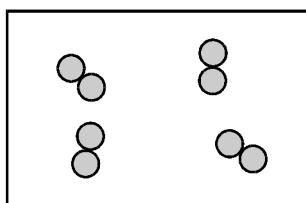
                                                                Maximum 5 marks
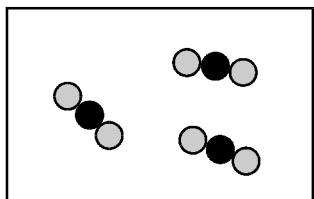
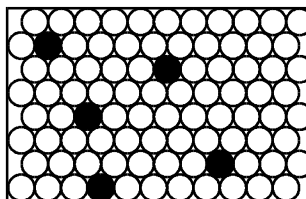**4.** The diagrams represent the arrangement of atoms or molecules in four different substances, A, B, C and D.

A

B

C

D

not to scale

Each of the circles, ○, ◎ and ● represents an atom of a different element.

(a) (i) Which substance is a compound?

…………

1 mark

(ii) Which substance is a mixture?

…………

1 mark

(iii) Which **two** substances are elements?

………… and …………

1 mark

(iv) Which **two** substances could be good thermal conductors?
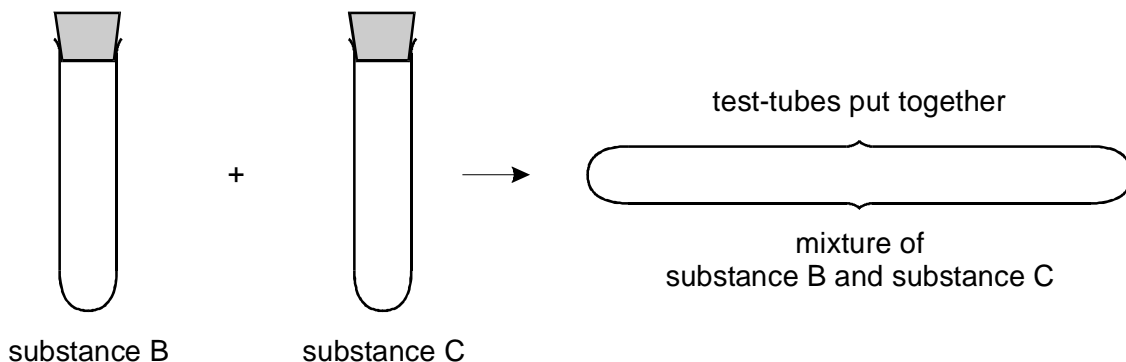
………… and …………

1 mark

(v)   Which substance could be carbon dioxide?

....

1 mark

(b)   The following experiment was set up. Test-tubes containing substances B and C were placed together as shown. The substances did **not** react.
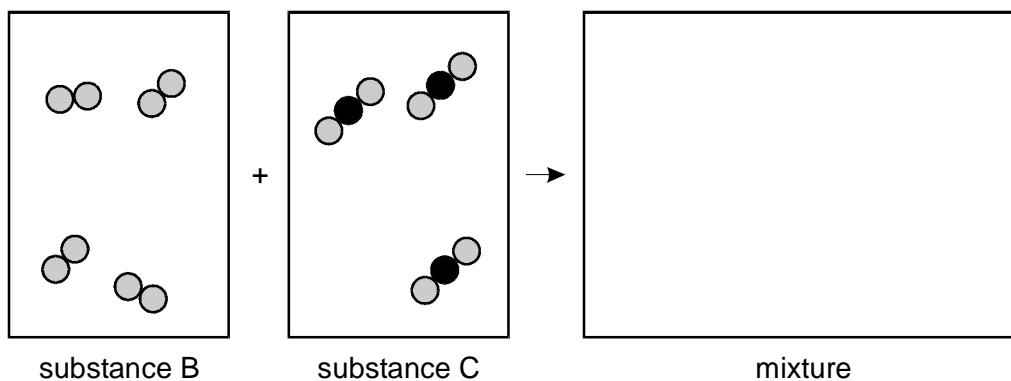They were left for five minutes.

test-tubes put together

+   ⟶

mixture of
substance B and substance C

substance B   substance C

(i)   How many molecules are there in the mixture compared to the total number in substances B and C?

....

1 mark

(ii)   Complete the diagram which is a model of this experiment.

+   ⟶

substance B   substance C   mixture

1 mark

Maximum 7 marks

5. These young rabbits look like their parents. This is because information about characteristics such as fur colour is passed from parents to their young.
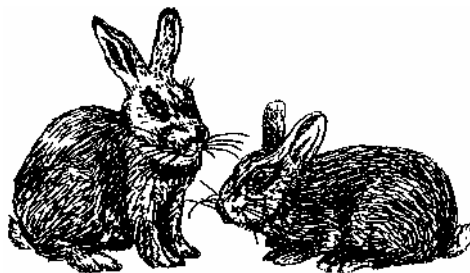
Choose words from this list to complete the sentences below.

body   **chromosomes**   **clones**   **cytoplasm**

genes   **nucleus**   **sex**

Information is passed from parents to their young in .... cells.

Each characteristic, e.g. fur colour, is controlled by ....

The structures which carry information for a large number of characteristics are

called ....

The part of the cell which contains these structures is called the

....

(Total 4 marks)

6. Blood contains plasma, platelets, red cells and white cells. Each has one or more important functions.

In the table below draw a line from each part to its function.

One part has two functions. Draw lines from this part to both functions.

Name of part of blood	**Function of part of blood**

Name of part of blood	Function of part of blood
	fights bacteria
red cell	
	carries dissolved hormones
platelet	
	carries dissolved urea
plasma	
	transports oxygen around the body
white cell	
	helps blood to clot

(Total 5 marks)

7. During the last hundred years many species of whales have been over-hunted. This has led to a dramatic decrease in their numbers. The graph shows the catches of two of these species, Fin whales and Sei whales, between 1956 and 1970.
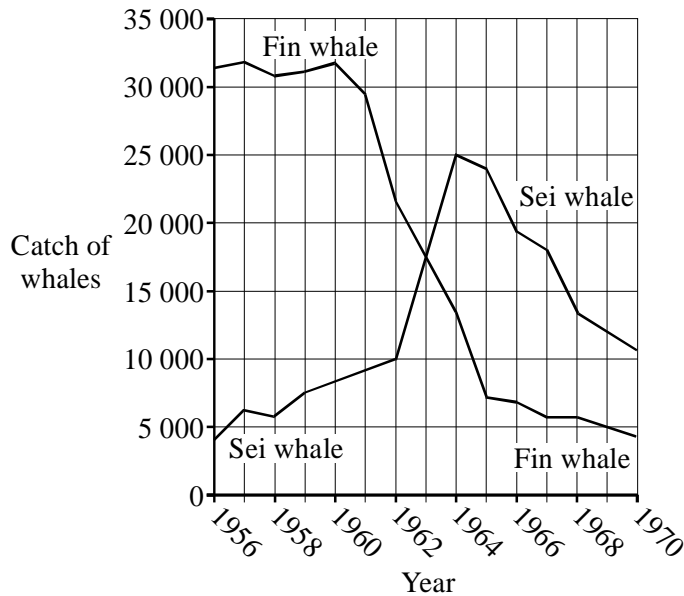
(a) When did over-hunting begin to affect the Fin whale population?

.... **(1)**

(b) Complete the sentence.

When a species is over-hunted many adults are killed. The population numbers

fall dramatically because the death rate is far greater than the ....

(1)

(c) (i) In what **year** were the catches of Fin whales and Sei whales the same?

.... **(1)**

(ii) Between 1963 and 1964 how did the catches of Fin whales and Sei whales alter?

Fin whales: ....

Sei whales: ....

(1)

(d)   Suggest why the catches of Sei whales increased between 1956 and 1964.

....

....

(1)
(Total 5 marks)

8.   The drawings show the heads of four birds, not drawn to scale. The birds feed in different ways.
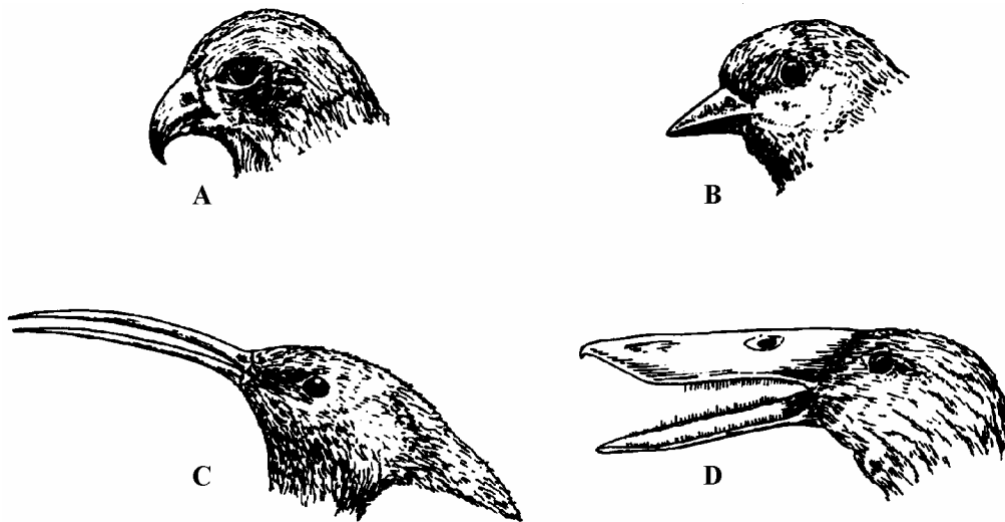
Which of the birds, A, B, C or D, is best adapted for:

1.   tearing flesh   ....

2.   finding insects in cracks in the ground   ....

3.   sieving small animals from mud?   ....

(Total 3 marks)

9. Plants are grown in glasshouses to protect them from the weather or extend the growing season.

Plants make food by photosynthesis.

$$6CO_2 + 6H_2O \xrightarrow[\text{light}]{\text{energy from}} C_6H_{12}O_6 + 6O_2$$
$$\text{glucose}$$
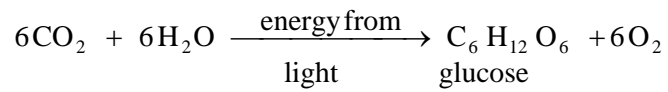
In winter, when days are shorter, glasshouses are heated to keep the enzyme reactions in plants at optimum rates.

What else should a grower do to make sure that the plants are photosynthesising at the optimum rate? Give a reason for your answer.

....

....

....

....

....

....
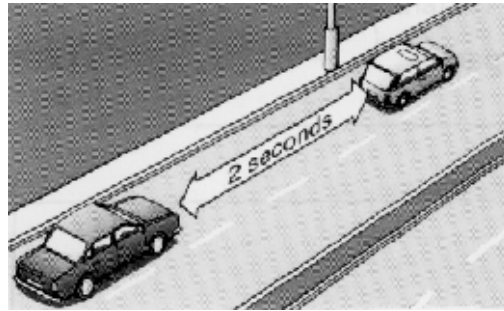
(Total 3 marks)

10. (a) The 'two second rule' is a rule for car drivers. The rule is as follows:

'Leave enough space between you and the vehicle in front so that you can pull up safely if it suddenly slows down or stops... A two second time gap may be sufficient... Use stationary objects (eg lamp-posts) to help you keep a two second gap.'

(The Highway Code, 1993)

(i) The traffic is moving at 20 m/s, and a driver is keeping to the 'two second rule'.
What is the distance between the driver and the car in front?

....

....

1 mark

(ii) The traffic increases its speed to 25 m/s, but the driver stays the same distance from the car in front.
She sees the car in front pass a lamp post.
How long will it take her to reach the same lamp post?

....

....

Answer: ………………….. seconds

1 mark

(b)   The driver decides to check her speedometer while driving along a motorway. She measures how long it takes her to travel 6 km. It takes her exactly 4 minutes. What was her speed in **km/h**?   Show your working.
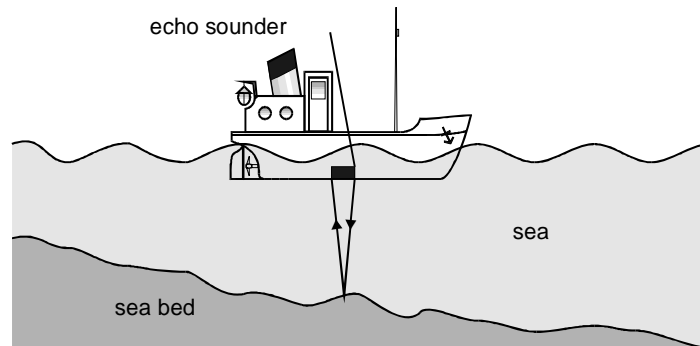
....

....

.... km/h

2 marks

(TOTAL: 4 marks)

11.   The diagram shows a boat using an echo sounder. It sends a pulse of sound waves which is reflected from the sea bottom. The reflected sound waves are detected by a sensitive microphone.

The time between sending and receiving the pulse is 0.005 s. The device calculates the depth of the sea, using the speed of sound in sea water, which is 1500 m/s.

(a)   Calculate the depth of the sea. Show your working.

....

....

....

2 marks

(b)   The boat moves into very deep water. Explain why the reflected pulse is too weak to be detected.

....

....

1 mark

(c)   The boat's 'echo sounder' could **not** be used in an aeroplane to measure its height above the ground unless it had been modified.

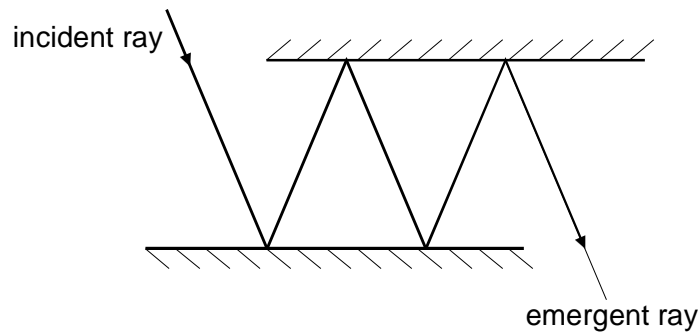Explain why the device will **not** give correct heights above the ground.

....

....

1 mark

(TOTAL: 4 marks)

12.   (a)   The diagram shows a ray of light reflecting several times between two parallel mirrors.

incident ray

emergent ray

(i)   What relationship is there between the angle of incidence for the **first** reflection and the angle of reflection for the **last** reflection?

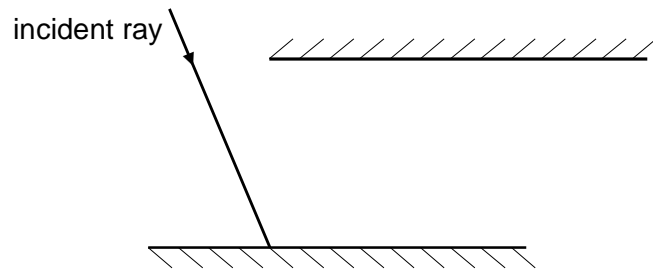...

1 mark

(ii)   Draw on the diagram above the following, for the first reflection:

• The angle of incidence

• The angle of reflection

1 mark

(b) In the diagram below, the angle of incidence has changed, but the mirrors are in the same positions.

incident ray
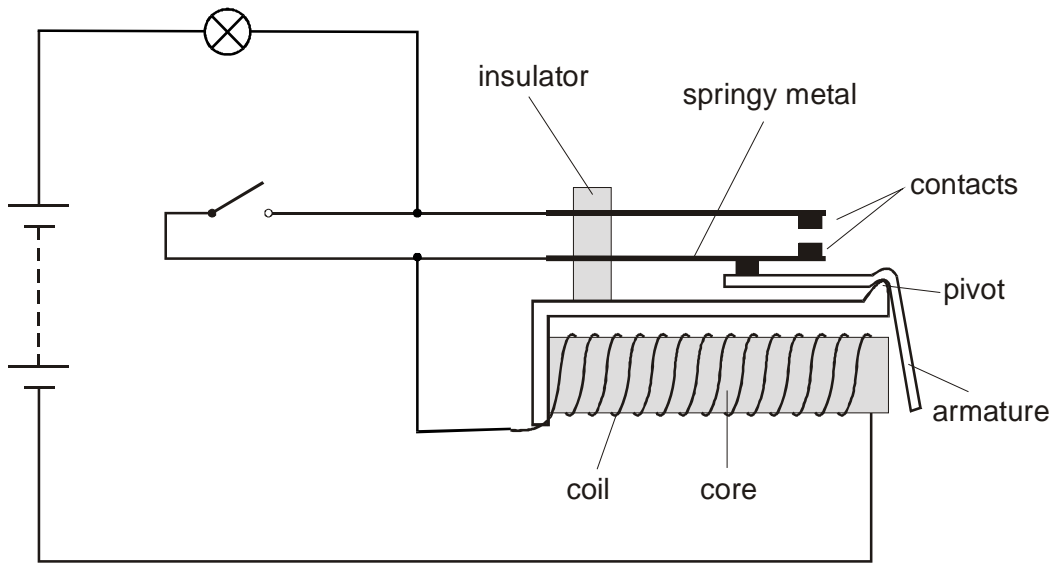
Draw the path of the ray and state below how many total reflections take place before the ray leaves the last mirror.

....

....

2 marks

(TOTAL: 4 marks)

13. The diagram shows an electromagnetic relay. The relay is connected in a circuit with a battery, a lamp and a switch.

(a) (i) Give the name of a suitable material to use for the core of the electromagnet.

....

1 mark

(ii) Give the name of a suitable material to use for the armature.

....

1 mark

(b) (i) Explain why the contacts come together when the switch is closed.

....

....

....

....

....
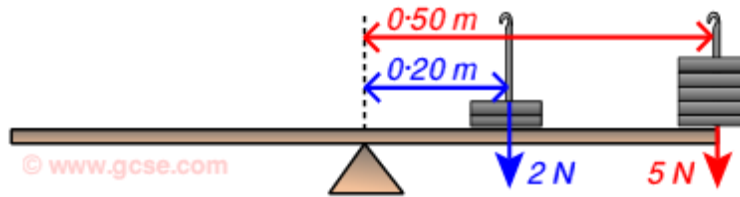
3 marks

(TOTAL: 5 marks)

14. A moment is defined as being the turning force around a pivot.

Mathematically:a moment = (perpendicular distance from the pivot) X (force applied)

In the example below, the moment of the first set of masses is:

Moment = 0.20m X 2N = 0.4

(a) (i) What units should be added to the answer above of '0.4'?

....

1 mark

(ii) Calculate the moment for the larger stack of masses, providing the correct final unit.

....

....

....

....

....