MAGNETIC COMPASS Mk2

TEACHERS/TUTOR NOTES & WORKSHEETS

The project will take probably two sessions for assembly and test.

BACKGROUND

- Since sailors began to sail the seas, the compass has been the most important instrument for navigation. Before the compass, boats would seldom navigate out of sight of land. It is not clear who invented the compass –magnetic rocks were discovered by the ancient Greeks in Magnesia (hence the word magnet) but it took the Chinese sailors to find that a piece of the rock when freely supported would always point in the same direction. The direction which the compass points is measured in degrees.
- Permanent magnets are generally made from steel but there are some very powerful magnets made from special alloys. They attract or repel only iron or steel or other magnets
- Magnets are directional and have two poles at opposite sides – the North Pole and the South Pole. Each magnet has a "magnetic field" around it and this can be seen if a magnet is placed under a piece of paper and iron filings are scattered on the paper. The pattern which the filings make shows the field with its lines of force. When two magnets are put close to each other, their fields interact and the lines of force cause the same poles to repel each other and opposite poles to attract.
- The Earth is an enormous but weak magnet with its magnetic field and lines of force. The poles are naturally at the North and South poles although not quite at the geographic poles or the centerlines about which the Earth spins. When using a compass, allowance is made for the difference between the poles and is called the "Magnetic Variation" and is added or subtracted to the direction or reading to obtain the true direction. In Great Britain the Magnetic variation is about 4.5 degrees and must be added to the magnetic direction to get the true direction.
- A piece of iron or steel can be magnetized by stroking it with a magnet or jolting it when in a magnetic field. The action is to cause all the molecules, which are all minute magnets, to lie in the same direction. The magnetism can be lost if it is jolted or hit without a magnetic field.
- Plain iron does not retain its magnetism well but steel is much better.

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CONSTRUCTION

The construction of the **compass card** with a pair of compasses and a ruler requires some practice. It is usual for the pupils to make several shots at it before they get it right. If pairs of compasses are not available it is possible to use a protractor and the inside of the case before it is glued to the base.

Session 1:

Whiteboard:

- History of compass - navigation is difficult at sea without a compass.
- Before the compass navigation was mainly by the sun or stars at night.
- In cloudy weather ships sailed in sight of the land.
- Natural magnetic rock called Lodestone was used.
- Magnets have North and South poles
- Same poles repel -- Opposite poles attract.
- The world is a large magnet and the south pole of the magnetic compass points to the North Pole of the world.
- Compass bearing is measured as an angle - 360 degrees in a full circle.
- Difference between magnetic north and true north.
- Moss grows on north side of trees (in northern hemisphere).
- Robert Peary discovered North Pole in 1909.
- Roald Amundsen discovered South Pole and just beat Scott who died in the attempt.
- An electromagnet is only magnetic when an electrical current passes through it.
- When the electricity is switched off it ceases to be magnetic.

Practical

- Fit pin to base and assemble.
- Magnetise compass needle.
- Fit brass bearing to needle and glue.

Session 2

Whiteboard:

- Revision of previous week.
- Effect of iron on magnet and compass
- Cannot test a compass on desk with iron legs. When iron ships were first used compass showed very large errors with disastrous results.
- Where are magnets used in the home? Refrigerator door seal -- Fridge picture magnets -- Cup-board door catch – Sharp knife rack
- Friction - compass needle must have minimum friction. Hence the use of a sharp pin and a brass bearing.

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Practical

- Construct compass card.
- Fit compass card and calibrate compass away from any iron objects.
- Competition for compass-which points nearest to magnetic north.

To give practical experience in using the Compass, create a simple Navigation Team Exercise for use in the school playground or hall.

Websites referring to a navigation compass

- Compass Wikipedia
- en.wikipedia.org/wiki/**Compass**

- Magnetic Compass Kjer Kjersmo
- www.learn-orienteering.org/old/lesson3.html

- Magnetic Compass Scouting Resources
- http://www.scoutresources.org.uk/SR/compass/index.html

- Magnetism
- www.zephyrus.co.uk/magnets.html

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WORKSHEET

1. How many degrees in a circle? .....

2 What bearing angle is a) due west ……

b) due east ……..

3. Give three examples of the use of magnets in the home.

.....

.....

.....

4. Draw a picture of the compass you have made so that next year's class can see how to make it.

5. How do you find north without a compass?

.....

.....

6. Who discovered the North Pole? .....

Who discovered the South Pole? .....

7. What is an electromagnet? .....

.....

8. Write a story about someone who lost their way home but had made a compass like yours.

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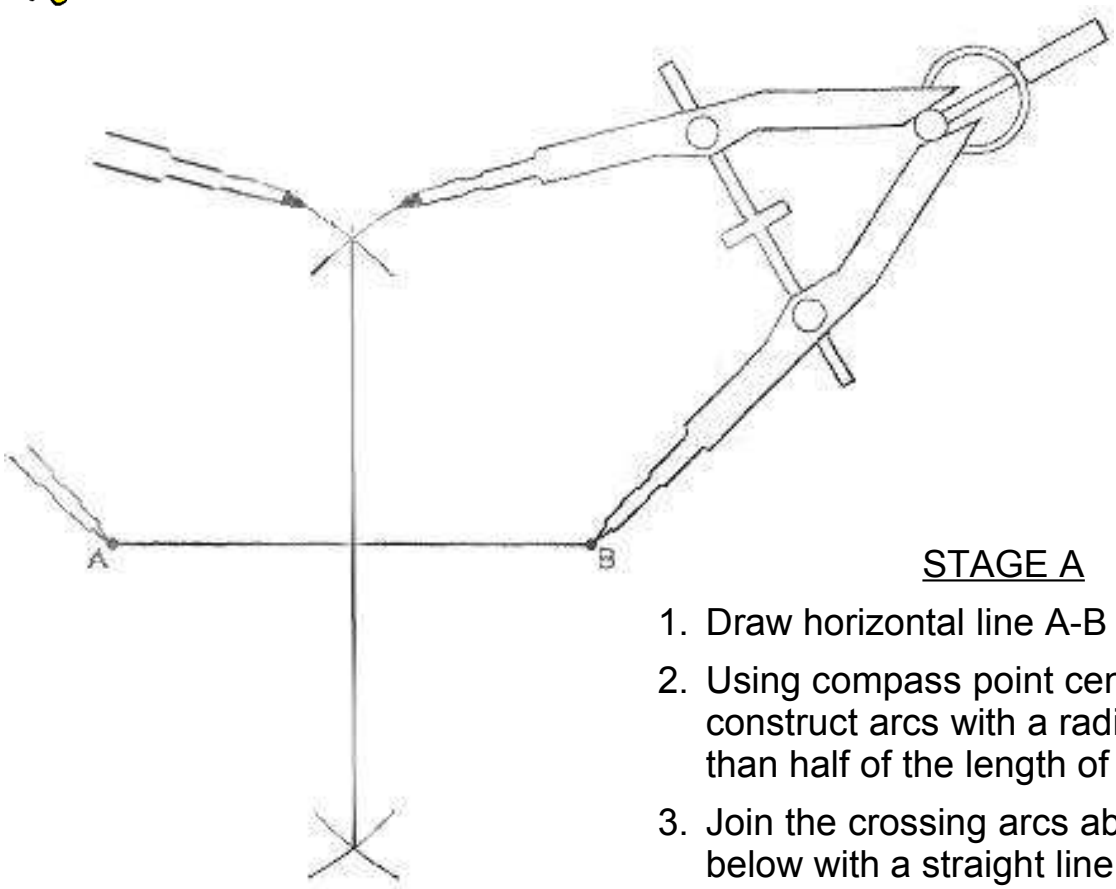
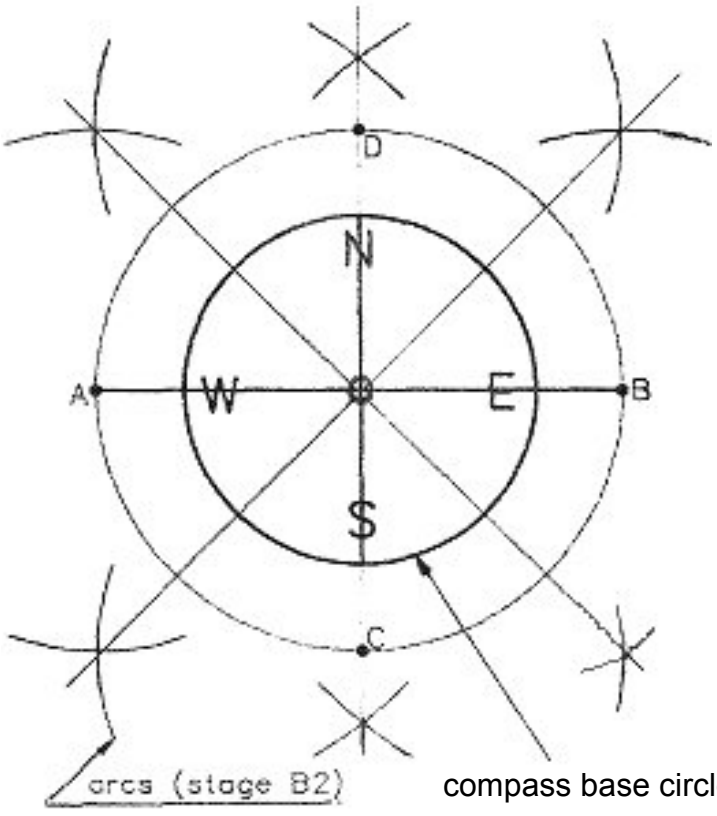
CONSTRUCTION OF THE COMPASS CARD

METHOD 1



STAGE A

1. Draw horizontal line A-B
2. Using compass point centres A and B, construct arcs with a radius greater than half of the length of A-B
3. Join the crossing arcs above and below with a straight line (at right angles to A-B)



compass base circle

STAGE B

1. Using compass point centre O, draw a circle with radius equal to A-O
2. Using compass point centres A, B, C & D draw the arcs shown
3. Join the crossing arcs with two straight lines as shown
4. Draw a circle of diameter to fit inside the compass base tube
5. Draw **N, S, E & W**
6. Cut out the card round the compass base circle.

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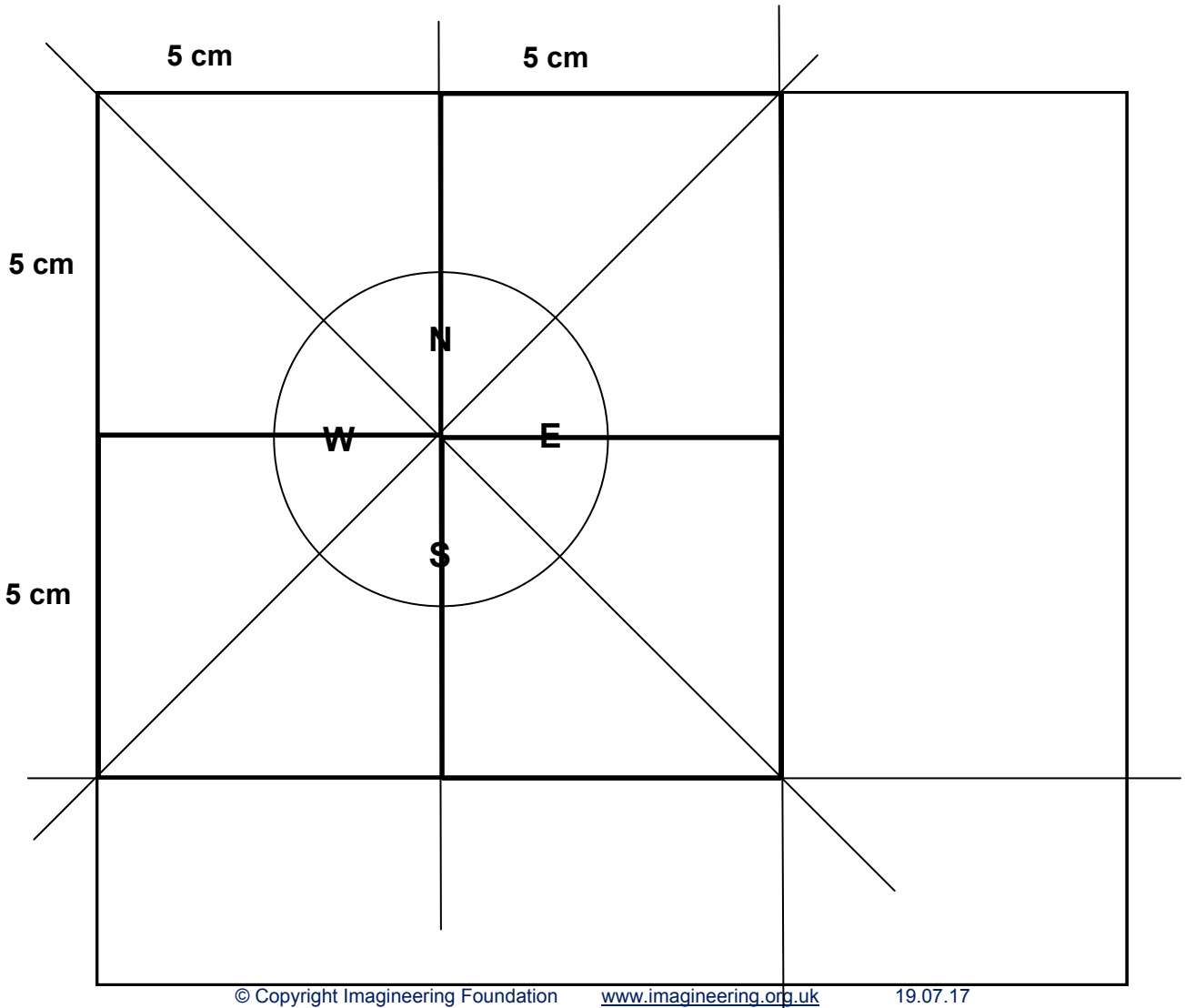
CONSTRUCTION OF THE COMPASS CARD

METHOD 2

This is a simpler method. Younger children often find Method 1 beyond them.

1. Mark the sides of the card at (say) 9 or 10 cm from each edge, so that a true square can be drawn with a pencil and ruler.
2. Draw the diagonals.
3. Bisect the sides by measurement with a ruler.
4. Join the mid-points of the sides using pencil and ruler
5. Use plastic base, compass case or compasses to draw a circle centred on the intersection of the lines.
6. Mark N, S, E, W etc on the lines, well inside the circle.
7. Cut card round circle. It may be necessary to trim the disc to give clearance inside the compass case.



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