Changing shadows planning investigation questions

- *Do you think a shadow stays the same at all times of the day?*
- *What might happen to a shadow if the Earth is moving?*
- *If the Earth wasn't moving and it was always the same time of day, would the shadow change?*
- *What could we do to track changing shadows?*
- *What could you use to create a shadow?*
- *What would we need to do in order to track a changing shadow?*
- *What would we need to keep the same throughout the investigation?*
- *How would we record our findings?*

Equipment list for shadow investigation

- *Rounders post and stand*
- *A sunny outdoor area*
- *Measuring tape*
- *Chalk*
- *Time! (a whole school day)*

Sticky-note investigations (after Goldsworthy and Feasy, 1997)

Stick filled in sticky-notes on the blank boxes to help organise thoughts - the sticky-notes can be moved as the investigation plan progresses

Enquiry question:
VARIABLES
Thing I could change/vary

Thing I could observe or measure

Ensuring my test is fair		
I will change		
I will observe		
I will keep these things the same		

Predicting	
What I think will happen to the length of the shadow as the hours pass	
What I think will happen to the direction of the shadow as the hours pass	
What I think will happen to the definition of the shadow as the hours pass	

Results and patterns	
Shadow features	**What I observed**
Length	
Direction	
Definition	

Changing shadows investigation questions

- *What is the significance of the shadow length?*
- *What do you think will change: direction, length, definition?*
- *Why is the shadow moving?*
- *What is causing the shadow?*
- *Where is the sun (light source) if the shadow is pointing in a certain direction?*
- *Why might the shadow become less defined?*
- *Why might the shadow become longer or shorter?*
- *Why might the direction of the shadow change?*

Use this link to support understanding and confirm observations:

Shadows, Children's University (Manchester University):

http://www.childrensuniversity.manchester.ac.uk/interactives/science/earthandbeyond/shadows/

Modelling/reconstructing changing shadow investigation questions (Y5)

- *What do you think each bit of equipment could represent?*
- *How could we recreate/model what happens during an Earth day?*
- *What will/has happened to the Lego™ person's shadow?*
- *Can you spot any pattern?*
- *Does this change your thoughts on what will happen to our outside shadow experiment?*

Modelling/reconstructing changing shadow investigation questions (Y6)

- *What do you think each bit of equipment could represent?*
- *How could we recreate/model what happens during an Earth day?*
- *How can the Lego™ person help us with our shadow investigation?*
- *Where will the Lego™ person be in the early morning/ late morning/midday/early afternoon/late afternoon?*
- *What will/has happened to the Lego™ person's shadow?*
- *Can you spot any pattern?*
- *Does it make a difference if you move the Lego™ person to the equator or southern half of the globe?*
- *Does this change your thoughts on what will happen to our outside shadow experiment?*

Modelling/reconstructing changing shadow investigation questions
(teacher reference)

- *What do you think each bit of equipment could represent (Earth, sun, person on the Earth)*

- *How could we recreate/model what happens during an Earth day? (move the globe/Earth)*

- *How can the Lego™ person help us with our shadow investigation? (they can be stuck on the globe and move with it – their shadow should change as they move)*

- *Where will the Lego™ person be in the early morning/ late morning/midday/early afternoon/late afternoon?*

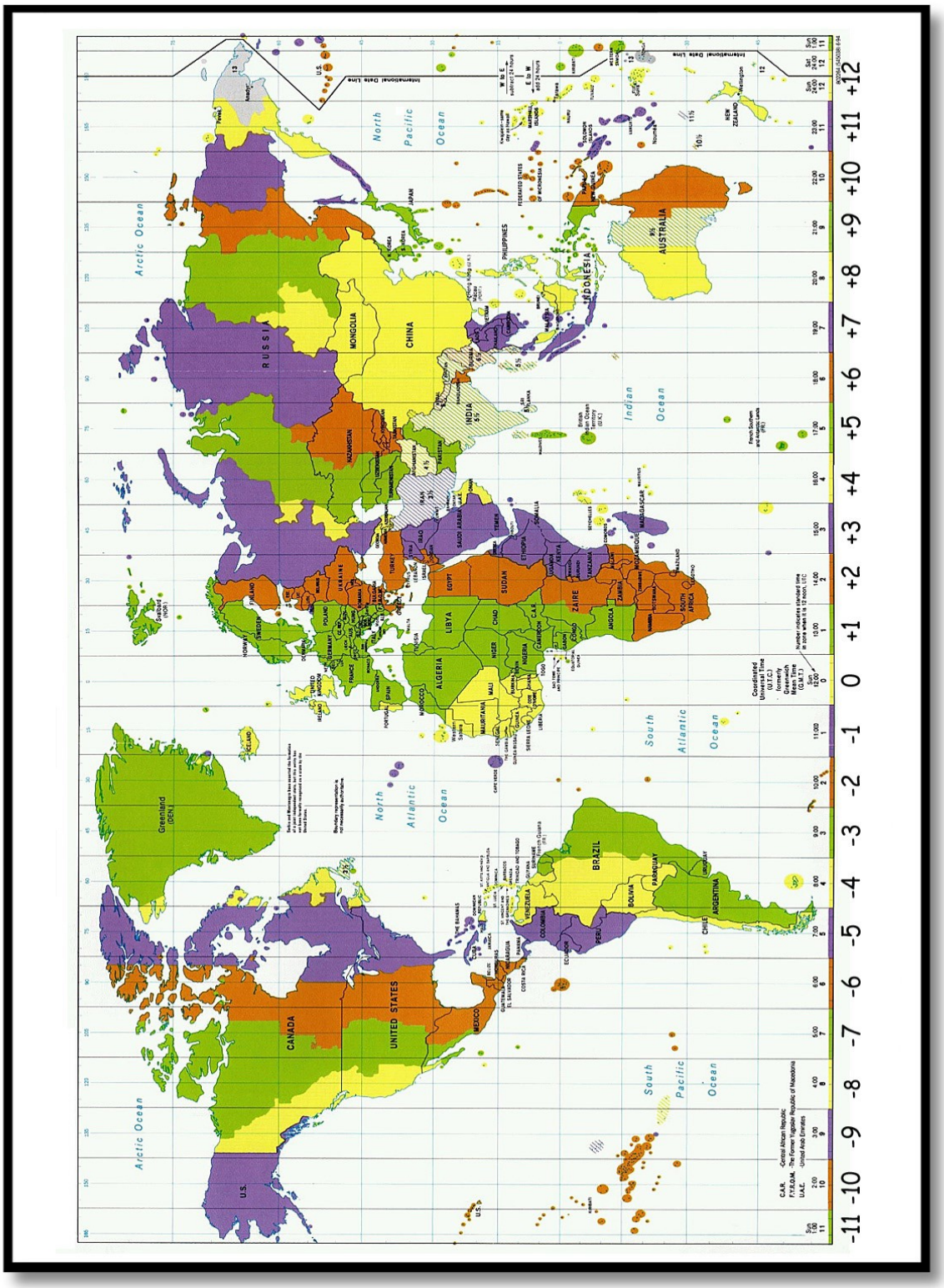
- *What will/has happened to the Lego™ person's shadow?*

- *Can you spot any pattern?*

- *Does it make a difference if you move the Lego™ person to the equator or southern half of the globe? (the shadow size and direction will change because of the angle of the light hitting the person)*

- *Does this change your thoughts on what will happen to our outside shadow experiment?*

Time Zone Map



Time of day simulator guidance

With a torch used as the Sun and four children holding city place cards, the children rotate, while the Sun holding person closes their eyes and says ‘stop’ at random moments. When stopped, the children try to decide what the time is in each place. Children can also investigate ‘if it is midday in the UK then it is X time in X’.

Get chn to pick their own four cities based on the time zone map, but for example might use:

- **Oxford**
- **Dhaka**
- **Auckland**
- **Chicago**

Time conundrums

The sun is in the western sky
The sun is in the eastern sky
The sun is directly overhead
The sun has turned a deep orange and pink colour and is spread across the western sky
The sun has turned a deep orange and pink colour and is spread across the eastern sky
Shadows are at their shortest
Shadows are at their longest
The sun is shining on exactly the opposite side of the Earth
The sun set a couple of hours ago
The Earth will turn to face the sun again in a few hours

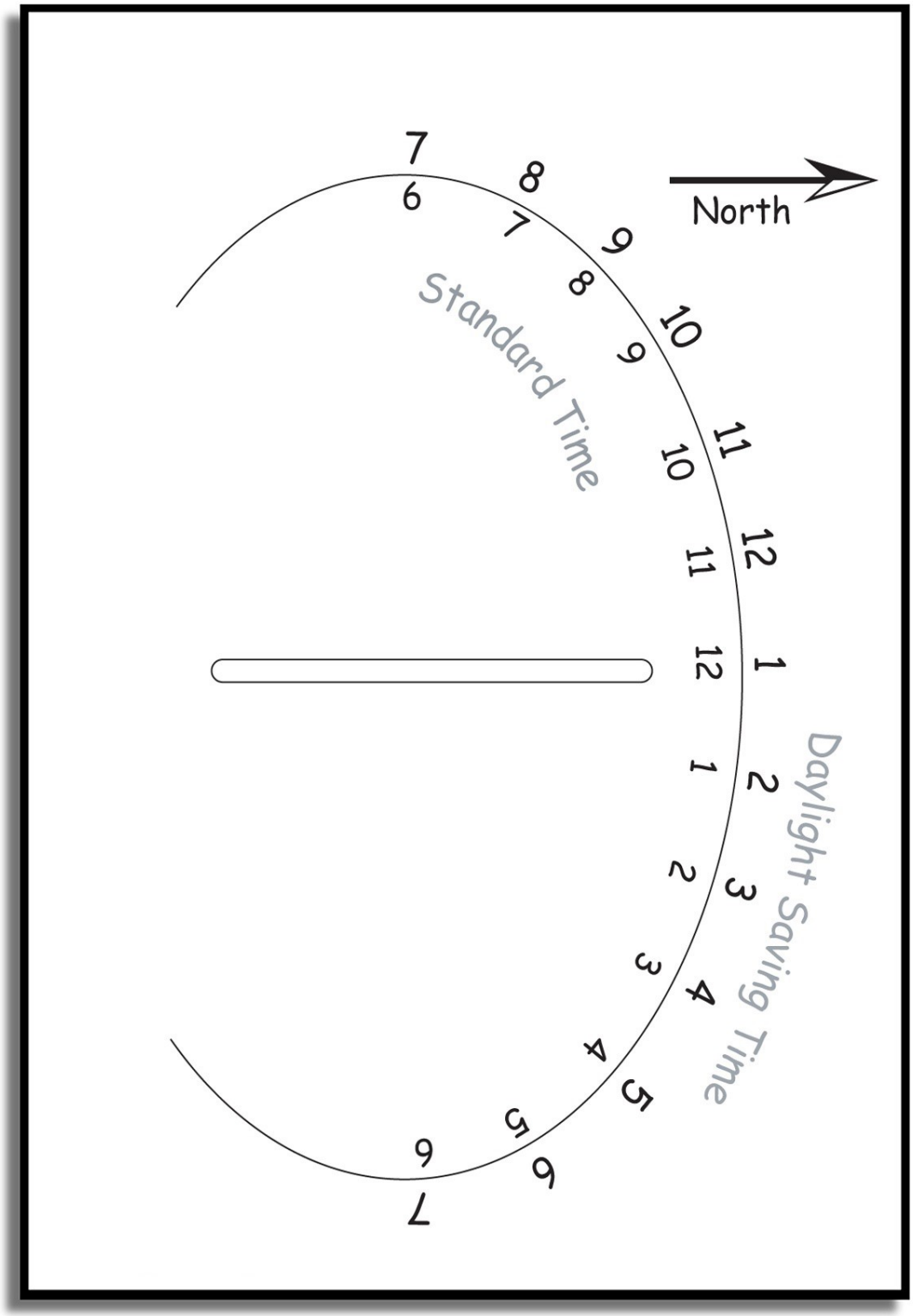
Possible times of day	
Morning	**Dawn**
Sunset	**Midday**
Early hours of the morning	**Afternoon**
Midnight	**Evening**

Sundial fact sheet

A sundial has a *gnomon* which points to the celestial pole (an imaginary line up into the celestial sphere from the north pole - it is very close to Polaris, or the North Star, which is usually used as the reference point) and which has its top edge parallel to the rotation axis of the Earth. A dial plate 'collects' the shadow. The gnomon's angle means the direction of the shadow is not influenced by the changing Sun's position in the sky throughout the year. As a result sundials are more accurate than shadow clocks at telling the time, but shadow clocks demonstrate how shadows change according to the season.

Sample sundials

Using a sun clock



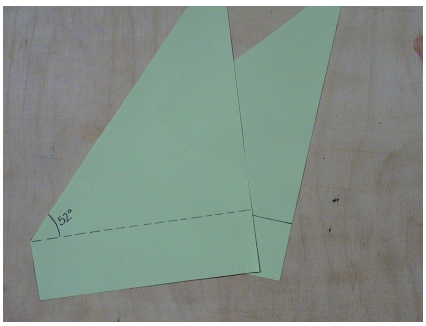
Make your own sundial (homework)

You will need:

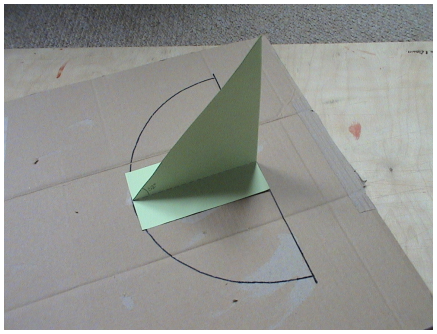
thick cardboard	flat piece of wood	scissors
ruler	pen	glue or sticky tape
compass	protractor	

What you do:

1. Draw the outlines of two marker shapes on to the cardboard and cut them out (52 degree triangles with an extra inch along the base for folding back and sticking).

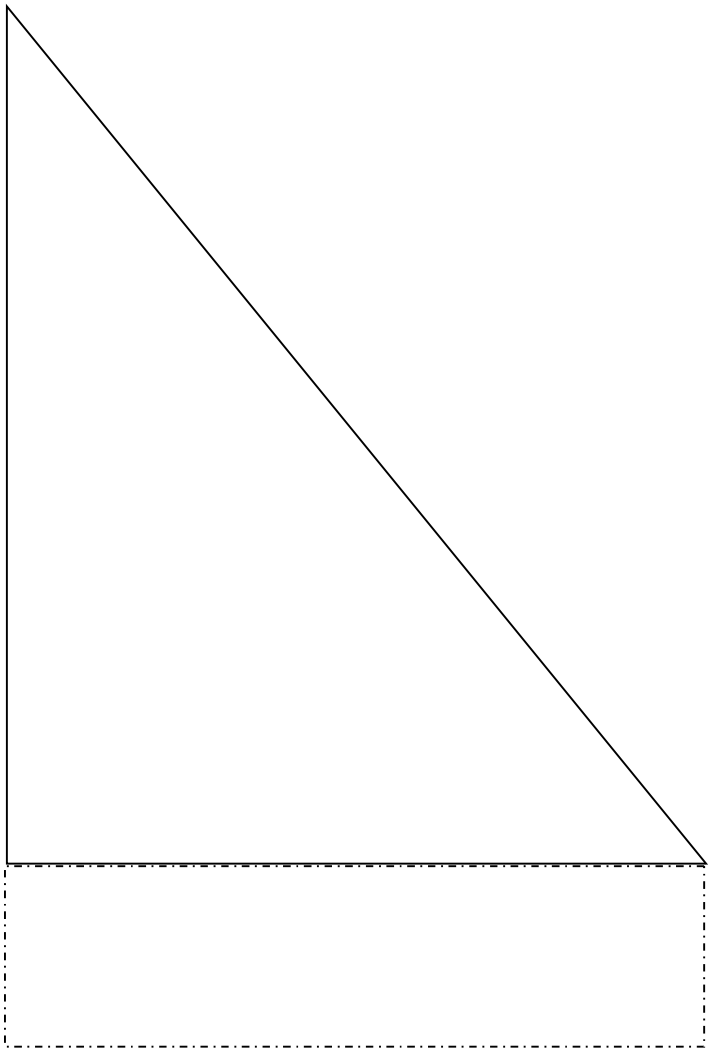


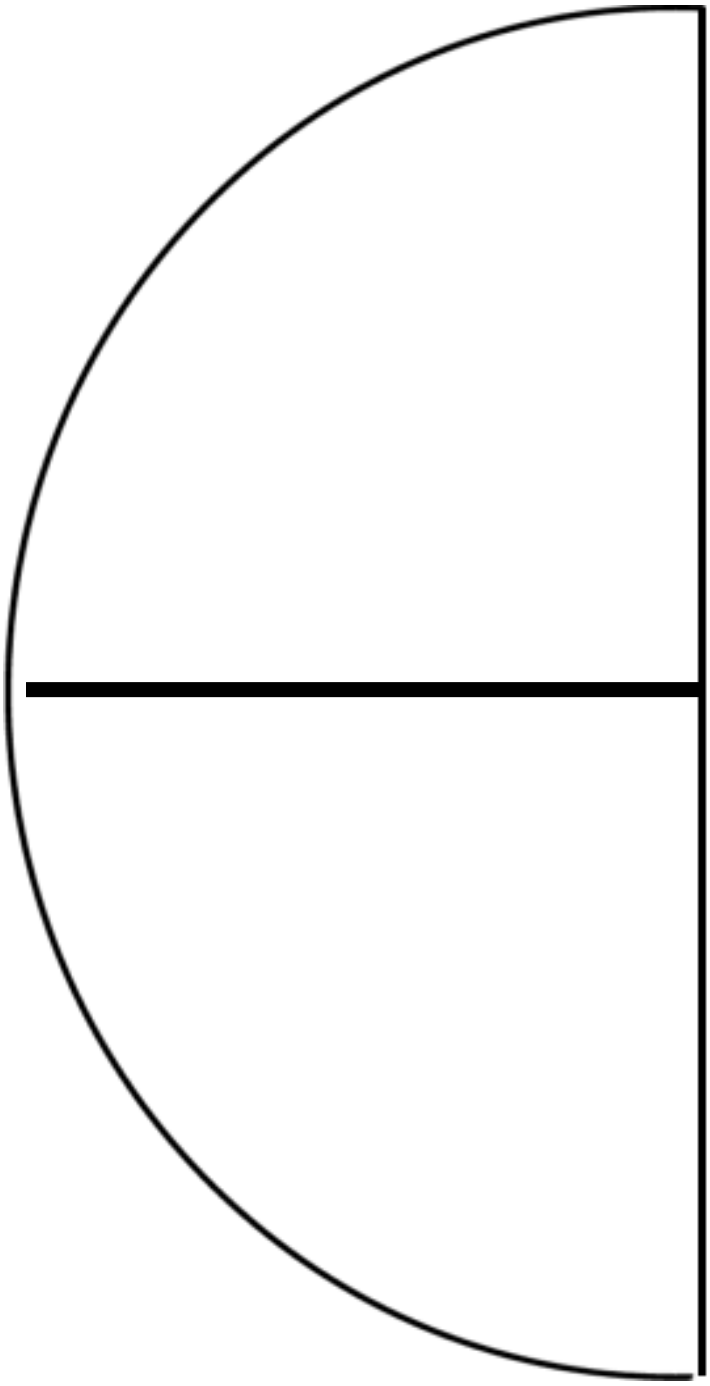
2. Score a line 1 inch in from the base of the triangle (long side) and fold back along the line.
3. Stick the two shapes back to back, leaving the inch section sticking out on both sides (these will be used to glue the marker down on to the wood and to give it stability).
4. Draw a half circle on a piece of wood (same radius as length of marker).
5. Stick the marker down the middle of the semicircle, leaving a quarter circle on each side.



6. Using a compass, point the marker towards the south and position the sundial on a flat surface.
7. Mark the position of the shadow cast by the sun on the semicircle every hour, on the hour.

Enlarge and Photocopy to make marker template:





Making a Simple Sundial (homework)

You will need:

- Plasticine
- Two rulers
- Sun

Take a ruler and make it stand on its edge using pasticine feet!

Place another ruler next to it. Make sure that 0cm is closest to the upright ruler.

Watch as the sun creates a shadow on flat ruler. Record the length of the shadow.

Note as the shadow shortens and lengthens during the day.

There you have it, a portable sun dial.