SURNAME ..... FIRST NAME .....

JUNIOR SCHOOL ..... SENIOR SCHOOL .....

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

LEVEL 2

PHYSICS

Wednesday 6 November 2013

Please read this information before the examination starts.

- This examination is 40 minutes long.
- Answers should be written on the question paper.
- Answer **all** the questions.
- Calculators and protractors may be required.

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1. Underline the answer which best completes each of the following:

(a) A unit to use when giving the area of this examination paper is

cm^2 **cm^3** **m** **m^3**

(b) The weight of a Common Entrance candidate is nearest to

4.5 N **45 N** **450 N** **4500 N**

(c) The forces on a car which is accelerating from rest are

balanced **downwards**

unbalanced **upwards**

(d) Light beams travel

as a single colour **at the same speed in every medium**

at an infinite speed **in a straight line**

(e) A loud sound has a

high frequency **high pitch** **large amplitude** **large speed**

(f) In order of increasing distance from the Sun, the planets are in the order of Mercury, Venus, Earth, Mars. The next planet is

Io **Jupiter** **Saturn** **Titan**

(g) An example of a renewable energy resource is

a battery **biomass** **coal** **oil**

(h) A stretched spring stores energy in the form of

chemical energy **kinetic energy**

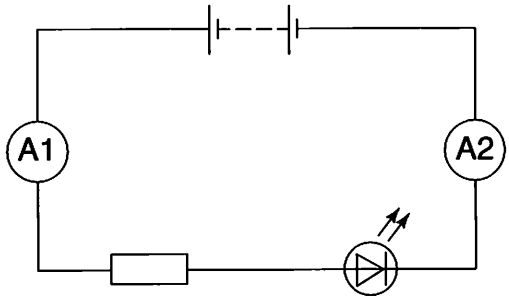
strain energy **thermal energy**

(i) A compass shows the direction of the magnetic North Pole of the Earth because the compass needle is

a good conductor **magnetised**

unbalanced **unmagnetised** (9)

2. A pupil sets up a circuit as shown in the circuit diagram below.

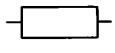


(a) State whether the circuit is connected in series or in parallel.

..... (1)

(b) Name the components shown below.

(i)  ..... (1)

(ii)  ..... (1)

(c) Ammeter A1 shows a reading of 0.02 A.
Suggest and explain what reading is shown by ammeter A2.

reading: .....

reason: .....

..... (2)

As the battery runs down, TWO changes might be observed.

(d) State and explain these two changes:

change 1: .....

change 2: .....

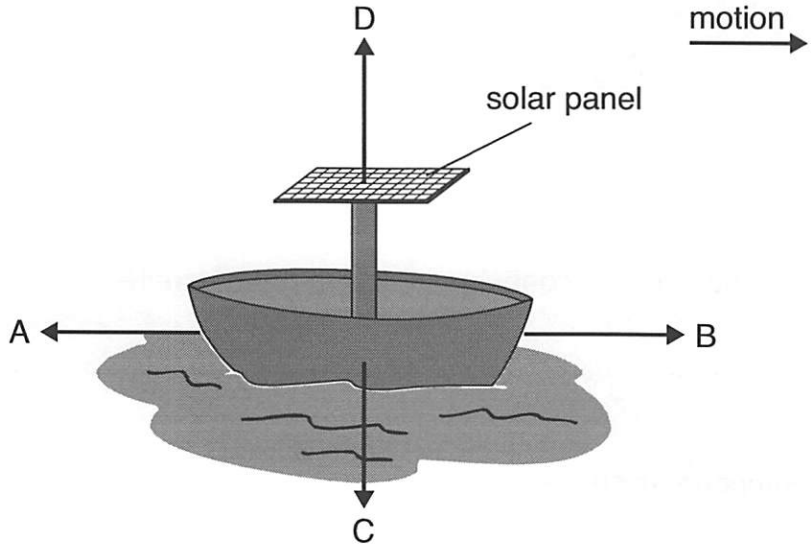
explanation: .....

.....

..... (3)

3. The picture below shows a model solar-powered boat on a small pond.

The solar panel powers a motor which drives a propeller which causes the boat to move to the right, as shown in the diagram.



(a) Complete the sentence in the box below.

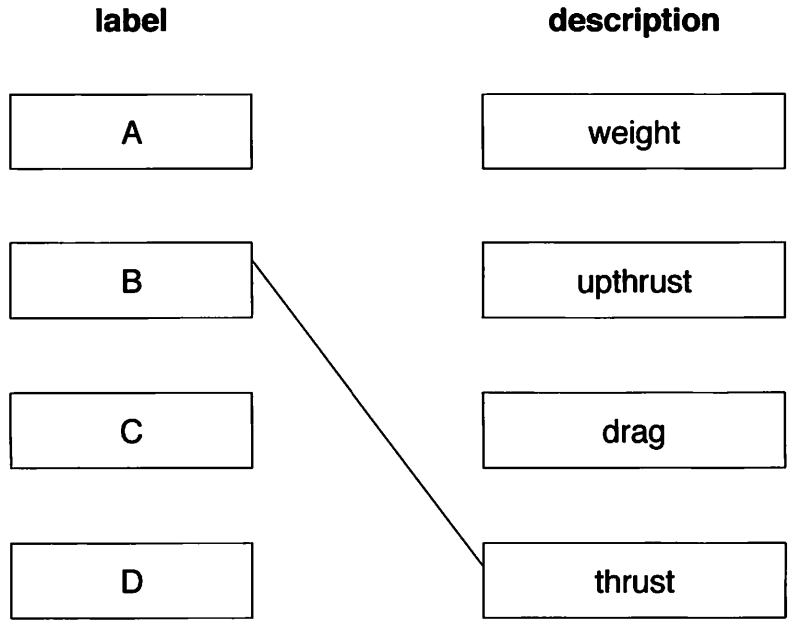
The energy transfer which is taking place in the motor is from ..... energy to ..... energy.

(2)

Four forces on the boat are labelled A to D on the diagram.

(b) For each of the forces listed in the boxes below, draw a straight line to the label which best describes it.

One has been done for you.



(2)

The boat is travelling across the water at a steady speed.

(c) State which, if any, of the forces shown are equal to each other.

.....

..... (2)

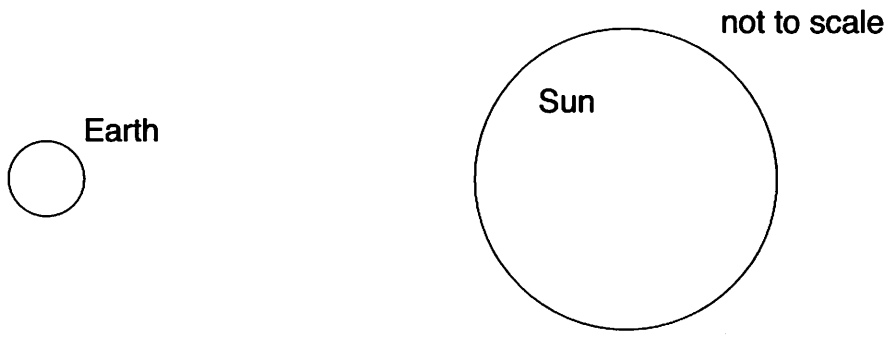
The Sun goes behind a cloud and the light falling on the solar cell is reduced.

(d) Suggest and explain what happens to the motion of the boat.

.....

..... (2)

4. There will be two total lunar eclipses (eclipses of the Moon) in 2014.
The diagram below shows the Earth in orbit round the Sun.



(a) On the diagram, show the position of the Moon at the time at which a lunar eclipse occurs.

Label this position L. (1)

Lunar eclipses can only occur at full moon.

(b) Suggest a reason for this.

.....

.....

..... (2)

(c) Describe the difference between a total lunar eclipse and a partial lunar eclipse.

.....

.....

..... (2)

Neither of the two total lunar eclipses in 2014 will be visible from Europe.

(d) Suggest a reason why they will not be visible from Europe.

.....

.....

..... (1)

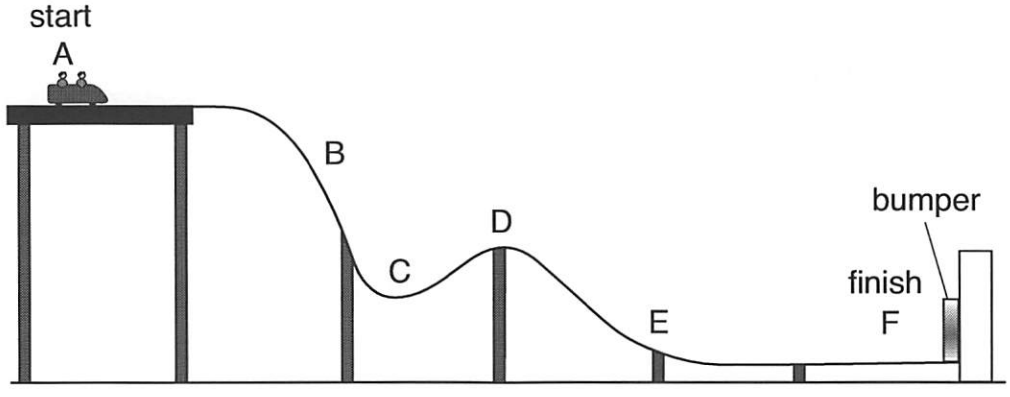
A total solar eclipse (eclipse of the Sun) is far less common. The next will be in 2015.

(e) On the same diagram opposite, show where the Moon is likely to be at the time of a solar eclipse.

Label this position S. (1)

5. The diagram below is of a theme-park ride.

The car starts at A and travels to F where it is stopped by a rubber bumper.



(a) State the points at which the car has no kinetic energy. ..... (1)

The car has no motor.

(b) State the form of energy which the car has at point A.

..... (1)

(c) State and explain what forms of energy the car has at point D.

.....

.....

..... (2)

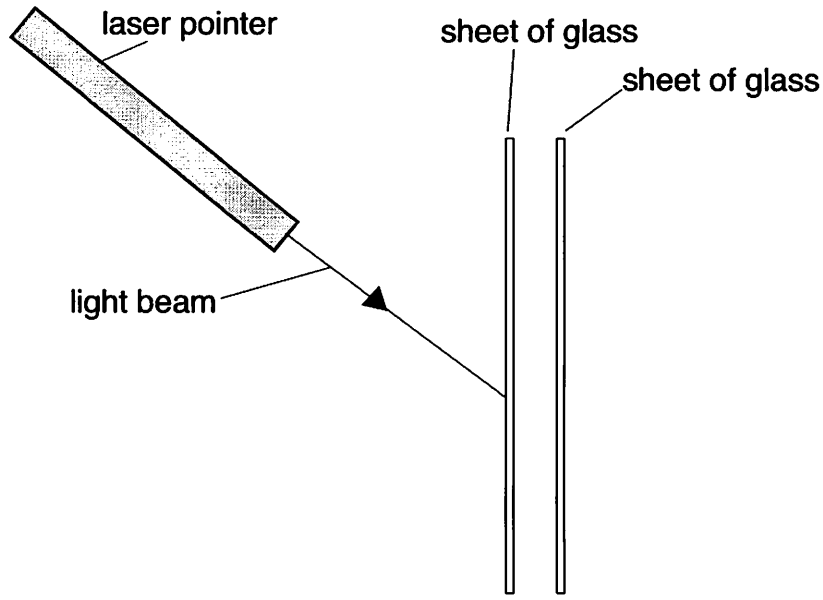
(d) Explain where the energy has gone when the car has stopped at point F.

.....

..... (1)

6. A laser pointer gives out a very fine beam of green light.

When it is shone at a double-glazed window the reflection consists of TWO spots of green light.



(a) On the diagram above,

(i) carefully draw the beam reflected off the first glass surface; (1)

(ii) label the angle of reflection. (2)

(b) (i) Explain why the reflection consists of TWO green dots.

.....

..... (2)

(ii) On the diagram above, show how the beam is reflected to give the second green dot. (2)

The reflections are not as bright as when the beam is reflected from a mirror.

(c) Explain why the beams are not as bright when reflected from the window.

.....

..... (1)

7. This question is about measuring the thickness of paper.

Some pupils have a large pile of paper. They want to find how many sheets are in the pile without counting them all.

(a) They take 25 sheets from the pile and find that the total mass of these sheets is 10 g.

(i) Name the measuring instrument they should use to measure the mass of the sheets.

..... (1)

(ii) Explain carefully what they should now do to find the number of sheets in the whole pile without counting them.

.....

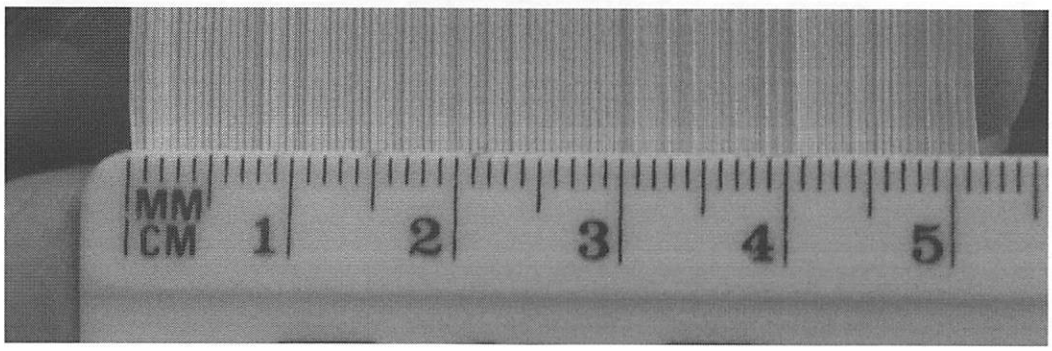
.....

.....

..... (3)

Having found that there are exactly 500 sheets, the pupils decide to measure the thickness of one sheet.

They hold the pile of paper tightly together and measure it with a ruler, as shown in the picture.



(b) Write down the thickness of the 500 sheets to the nearest 0.5 mm.

thickness = ... mm. (1)

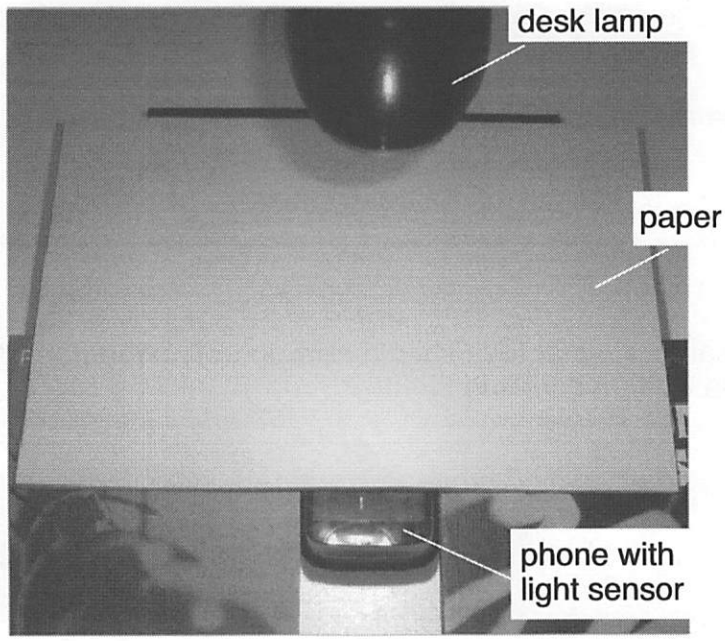
(c) Calculate the thickness of one sheet, in mm.

.....

..... (2)

To try another way of finding the thickness of a sheet, the pupils use a desk lamp and the light sensor on a mobile phone.

They measure how much light is let through by different numbers of sheets.

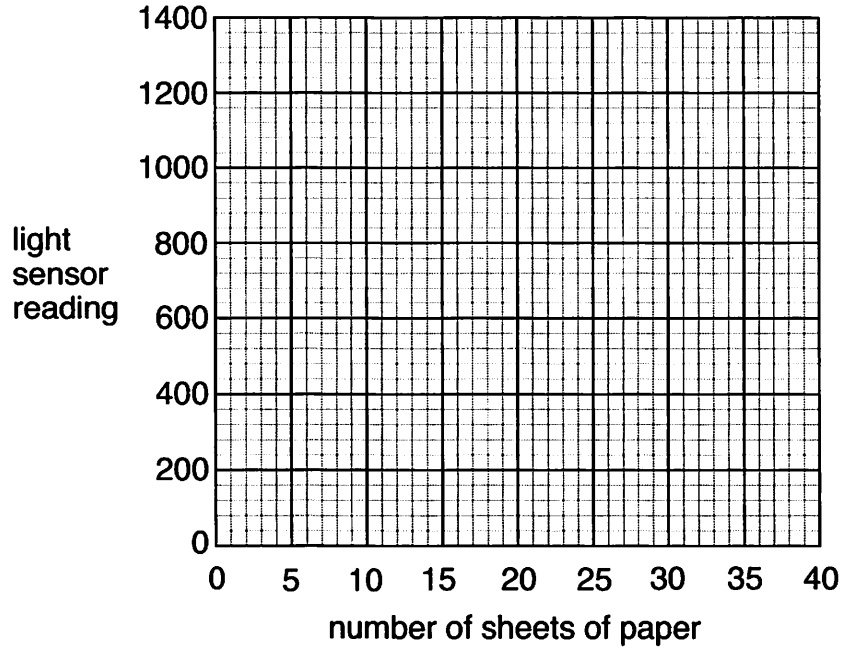


Their results are shown in the table below.

number of sheets	light sensor reading
1	1280
2	640
6	320
10	220
16	160
36	90

(d) (i) On the grid, plot the results of their experiment. (2)

(ii) Draw a line or curve of best fit to complete the graph. (1)



(e) Explain whether or not you think the arrangement used in this experiment is good for counting sheets of paper.

.....

.....

..... (2)

The light sensor circuit in the mobile phone is quite complicated but it is possible to make a simple light sensor circuit in the lab using an ammeter and other circuit components.

(f) In the space below, draw a possible circuit for a light sensor which gives a different reading on the ammeter for different light levels.

Use correct circuit symbols.

(3)

(Total marks: 60)