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

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

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

PHYSICS

Wednesday 27 January 2010

Please read this information before the examination starts.

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

28310232

© Independent Schools Examinations Board

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

(a) The object in this list which is not a planet is

Earth **the Moon** **Neptune** **Uranus**

(b) A renewable energy resource is

coal **gas** **oil** **tidal**

(c) An electrical component which only allows current to flow through it in one direction is a

fuse **lamp** **LED** **resistor**

(d) The unit of force can be written as

F **kg** **N** **Pa**

(e) A planet further away from the Sun than Jupiter is

Mars **Mercury** **Saturn** **Venus**

(f) The increase in the length of a spring when it is stretched is called its

elasticity **elastic limit** **extension** **extra energy**

(6)

2. An object has a mass of 2 kg and a base area of 4 cm^2.

On Earth, a gravitational force of 10 newtons acts on every kilogram.

(a) Calculate the weight of the object.

Give the correct unit.

..... (2)

(b) Give the equation which relates pressure, force and area.

..... (1)

(c) The object is placed on a flat surface.

Show that it exerts a pressure of 5 N/cm^2.

.....

..... (2)

If you were to take the object to the Moon and place it on a flat surface, some values would be different.

(d) Write 'larger', 'smaller' or 'the same' beside each quantity below to show how its value on the Moon compares with its value on Earth.

(i) the force it exerts on the flat surface .....

(ii) the area in contact with the flat surface .....

(iii) the pressure it exerts on the flat surface ..... (3)

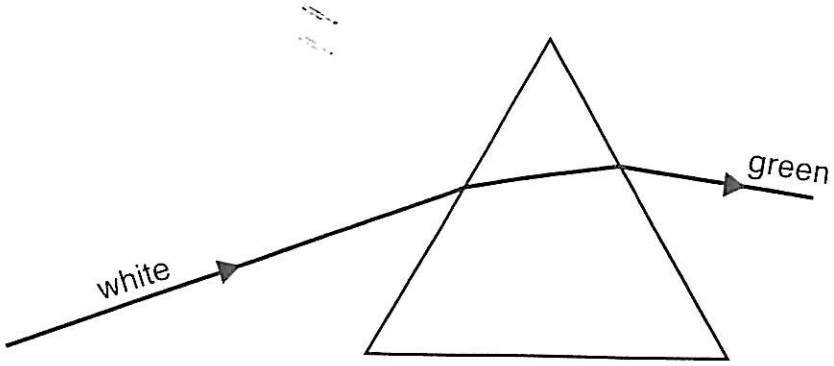
The object is lifted and held at rest a few centimetres above the flat surface.

(e) What form of energy has it gained? ..... (1)

(f) Will this gain of energy be less, more, or the same if the experiment is repeated on Earth?

..... (1)

3. A narrow beam of white light is shone at a triangular glass prism.
White light consists of a mixture of many colours.
The diagram shows the path taken by green light.



(a) Explain how you could produce a narrow beam of white light.

.....

..... (2)

(b) Explain why light refracts (changes direction) when it enters glass.

.....

..... (1)

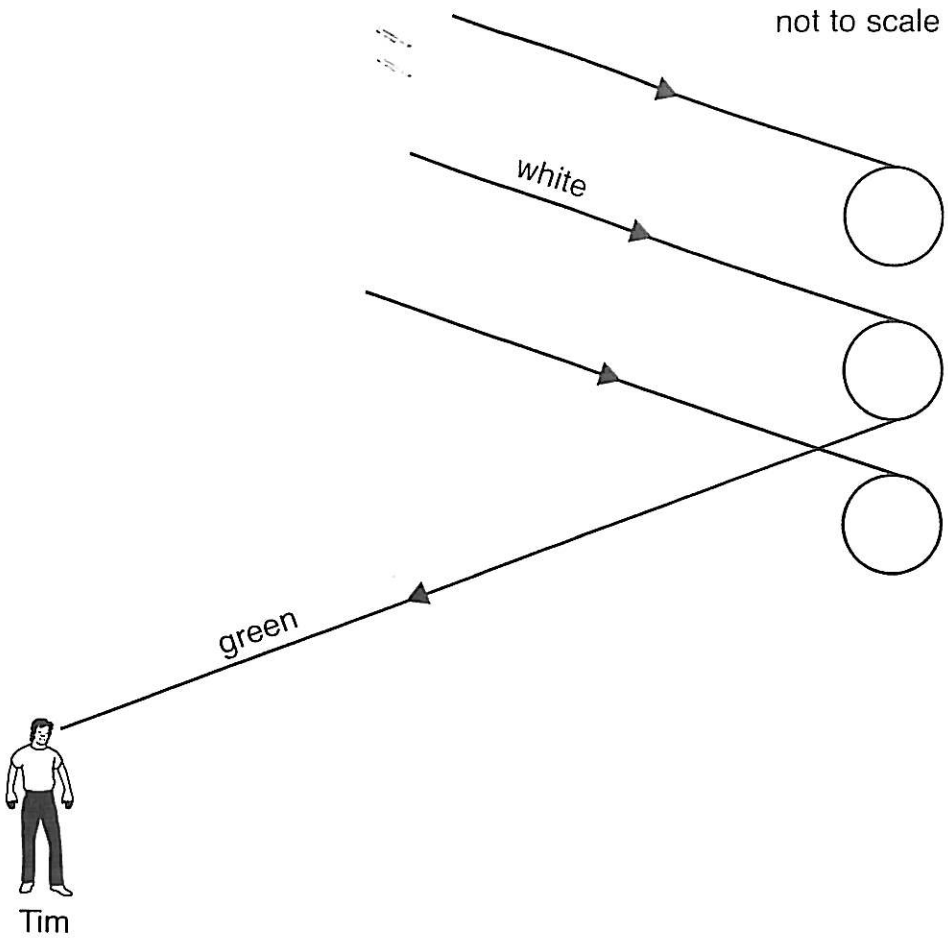
(c) Draw on the diagram the approximate path taken by blue light. (2)

(d) We say that a prism *disperses* the white light.
Explain what this means.

.....

..... (1)

The diagram below shows three rays of white light shining onto three raindrops.
As viewed by Tim, the middle raindrop looks green.



The light reaching Tim has reflected off the back surface of the raindrop.

(e) Draw on the diagram the path taken by the green light inside the middle raindrop. (2)

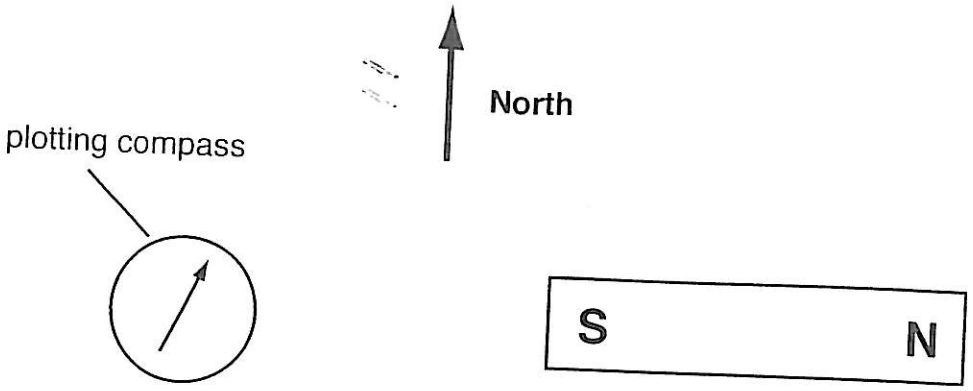
The lowest raindrop would look blue to Tim.

(f) State a possible colour which the highest raindrop could look to Tim.

..... (1)

(g) Draw on the diagram to show where Tim would need to stand for the lowest raindrop to look green to him. (2)

4. John places a plotting compass close to the south-seeking pole of a magnet.
This makes the compass needle deflect away from North, as shown below:



John measures the angle through which the compass needle deflects.

He then moves the plotting compass further to the left of the magnet and measures the new angle of deflection.

He repeats this process several times.

His results are shown in the table below.

distance from magnet, in cm	angle of deflection of needle towards magnet, in degrees
5	89
10	83
15	67
20	45
25	27
30	16
35	10
40	7

(a) Which of the two variables, distance from magnet or angle of deflection, does John deliberately change?

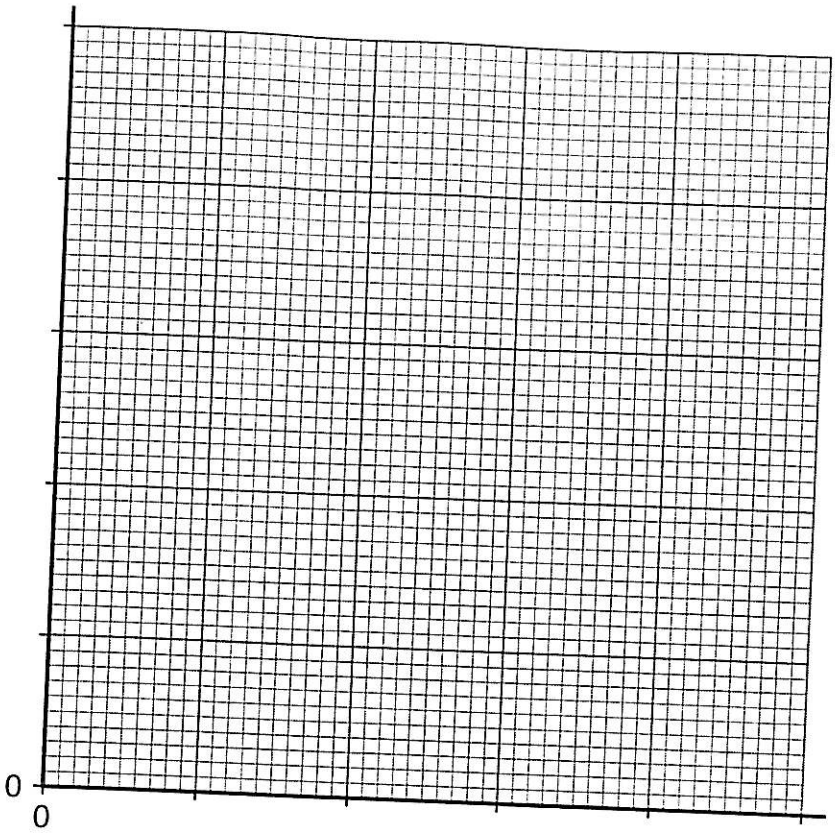
.....

..... (1)

(b) (i) On the graph grid below, label both axes and add sensible scales to them. (2)

(ii) Plot the data given in the table. (2)

(iii) Draw a suitable line of best fit. (2)



(c) Using your graph, how far from the magnet should the compass be placed for the needle to deflect 60°?

..... (1)

John repeats the experiment with the magnet the other way round, so that its north-seeking pole is nearest the plotting compass.

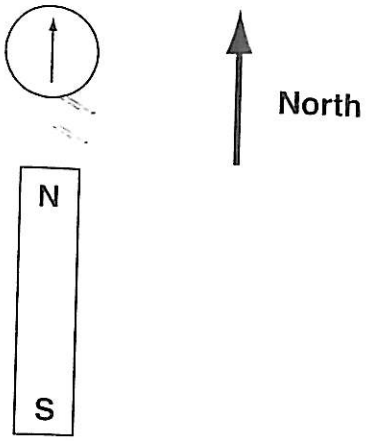
(d) Explain what effect this will have.

.....

.....

..... (2)

John carries out the experiment for a third time, as shown below:

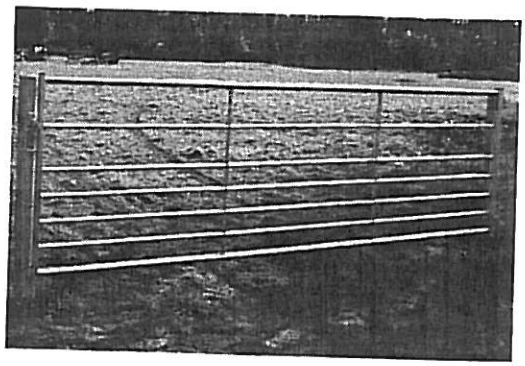


(e) Explain why the needle does not deflect in this case.

.....

..... (2)

5.



Laura uses a stick to tap the horizontal bars of a metal gate like the one in the picture.

(a) Explain why this makes a sound.

.....

..... (1)

(b) Suggest how the sound might be different if she hits the vertical bars of this gate with the stick.

.....

..... (1)

Laura pulls on the handle with a force of 15 N in order to open the gate.
The handle is 3.2 m from the hinges.

(c) (i) Give the equation which relates the force, its distance from the pivot and the moment.

..... (1)

(ii) Show that the moment of the force is 4800 N cm.

.....

..... (2)

(d) Explain why the handle is placed as far away as possible from the hinges.

.....

..... (1)

6. Jenny is looking at a wind turbine on a nearby hillside.

She decides to time how long it takes to complete one rotation, using her digital stopwatch.

She times one rotation and finds that it takes 1.84 s.

(a) Give one reason why this measurement may not be very accurate.

.....

..... (1)

She decides that it would be better to measure how long it takes the turbine to complete ten rotations and that she will take this measurement four times.

(b) (i) Explain why it is better to time ten rotations rather than just one.

.....

.....

..... (2)

(ii) Explain why it is sensible to take this measurement several times.

.....

.....

..... (2)

Her four readings are shown in the table below.

trial	time for 10 rotations, in seconds
1st	18.20
2nd	18.12
3rd	20.11
4th	18.25

(c) (i) Although the wind was constant, one of Jenny's readings is much larger than the others.

Suggest what she might have done wrong.

.....

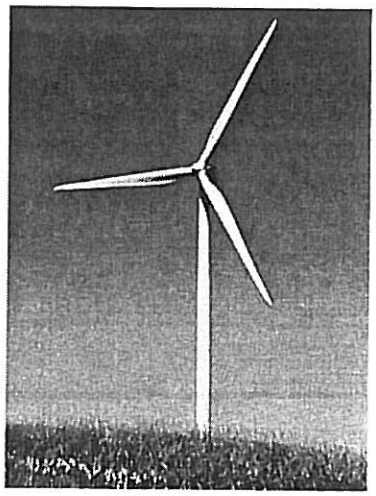
..... (1)

(ii) What should she conclude is the time taken for 10 rotations?

.....

..... (2)

The picture shows the wind turbine which Jenny timed.



(d) Explain at which point in its rotation it would be best for Jenny to start her stopwatch.

You may draw a diagram if this helps.

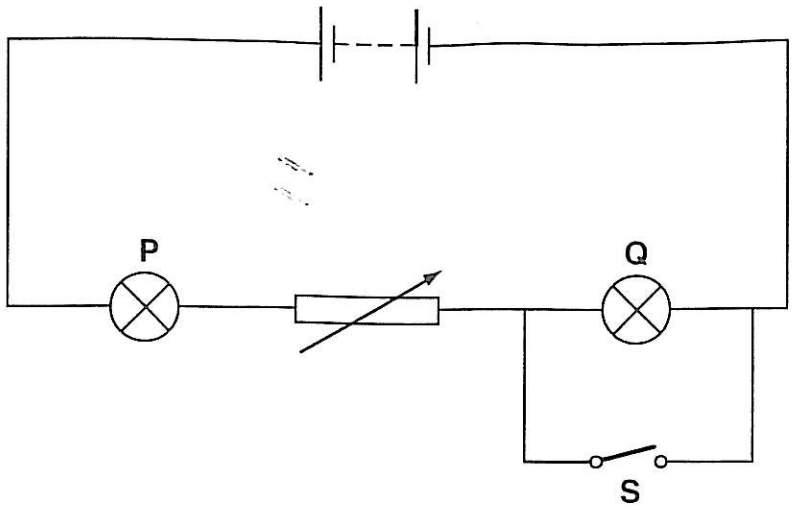
.....

.....

..... (2)

TURN OVER FOR QUESTION 7

7.



Two similar lamps **P** and **Q** are connected as shown in the circuit above.

(a) The table below is used to record their brightness when changes are made to the circuit. *(Some boxes have been completed for you.)*

In each of the empty boxes write 'out', 'dimmer', 'normal' or 'brighter' to indicate how the brightness of each lamp compares with its original 'normal' brightness.

situation	brightness of **P**	brightness of **Q**
as shown in the circuit diagram	normal	normal
resistance of variable resistor adjusted	brighter	
switch **S** closed		
lamp **P** breaks	out	

(4)

(b) Name two components which are connected in parallel in this circuit.

.....

(1)

(Total marks: 60)