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

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

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

PHYSICS

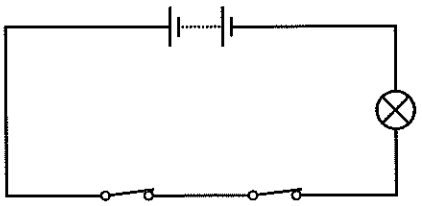
Wednesday 3 June 2009

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.

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

(a) In the circuit below:



(i) the two switches are in **parallel** / **series** with each other.

(ii) the circuit could be described as an **AND** / **OR** circuit.

(b) The table below gives the densities of four objects.

object	density, in g/cm^3
A	0.9
B	2.5
C	7.8
D	8.3

(i) If all the objects have the same mass, the one which would have the greatest volume is

A **B** **C** **D**

(ii) If object **B** has a volume of 100 cm^3, its mass is

0.25 g **40 g** **250 g** **2500 g**

(c) An object has a mass of 80 kg.

On the Moon, where gravity exerts a force of 1.6 N on 1 kg, the weight of the object will be

50 N **80 kg** **128 N** **800 N**

(d) A lady is walking on a sandy beach.
The heels of her shoes sink into the sand.
When she changes her shoes for ones with larger heels, they do not sink in so far.
This is because

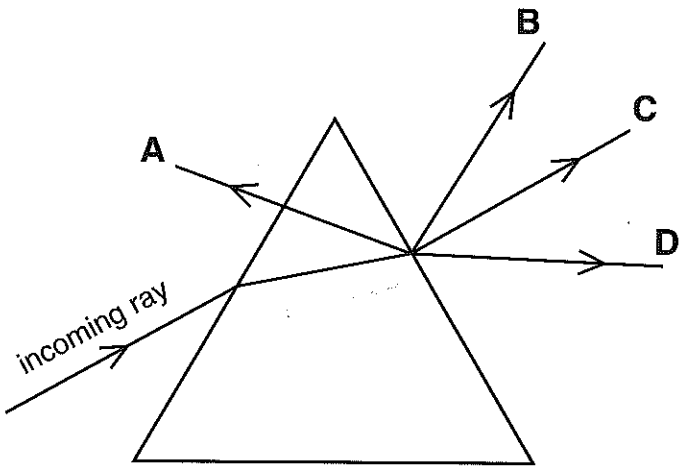
the force on the ground is now bigger

the force on the ground is now smaller

the pressure on the ground is now bigger

the pressure on the ground is now smaller

(e)



The diagram above shows a ray of light entering a triangular glass prism.
When the light leaves the prism it will travel along path

A **B** **C** **D**

(7)

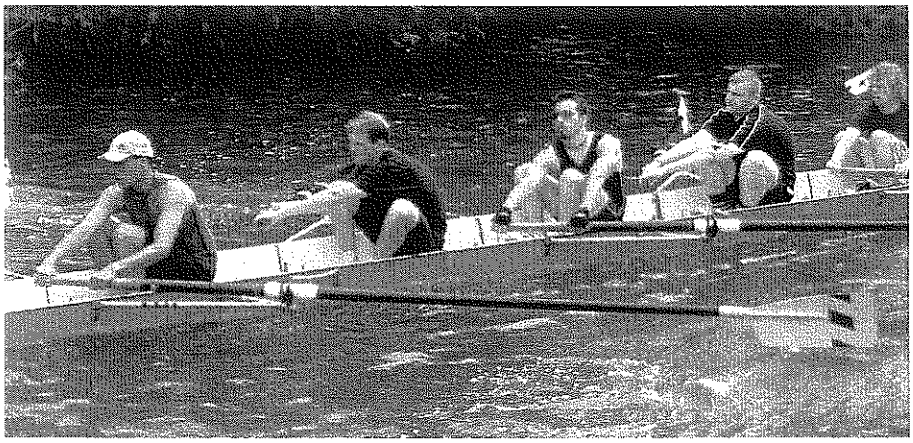
2. (a) Draw the circuit symbol for a light-dependent resistor (LDR).

(1)

(b) What happens to the resistance of a light-dependent resistor when it is put in the dark?

..... (1)

3. The photograph below shows part of a boat used in the sport of rowing.



(a) What is the energy transfer taking place in each rower as he pulls the oar through the water?

.....

..... (2)

(b) Modern boats are built to be as light and as narrow as possible.
Suggest why each feature is an advantage when racing.

light: .....

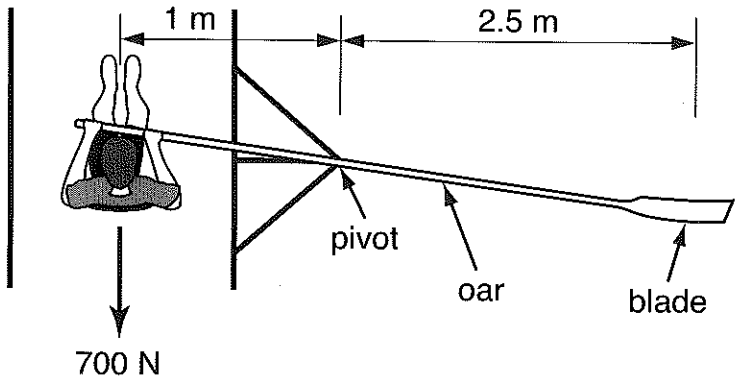
..... (1)

narrow: .....

..... (1)

The diagram below shows one rower pulling on his oar.

not to scale



(c) Explain why it is an advantage for the part of the oar between rower and pivot to be shorter than the part of the oar between pivot and blade.

.....

.....

..... (2)

(d) A rower can exert a maximum force on the oar of about 700 N.
Calculate the maximum force exerted by the blade on the water.

.....

.....

.....

..... (3)

4.

animal	typical frequency of hearing range, in hertz	
	lowest	highest
sheep	100	30 000
cat	45	64 000
dog	65	45 000
bat	2000	110 000
human	60	20 000
dolphin	75	120 000

(a) From the table above, explain if it is possible for a shepherd to blow a whistle so that his dog can hear the whistle but humans and sheep cannot.

.....

.....

..... (2)

Bats emit pulses of high-frequency sound to find their prey.
The time taken for the echo of a pulse to be heard by a bat tells it where its prey is.

(b) One other animal listed uses the same method for finding its prey.
Suggest which one.

..... (1)

A bat emits a very short pulse of sound and hears an echo from a moth 0.1 s later.
Sound travels at 340 m/s in air.

(c) (i) State the equation which relates distance to speed and time.

..... (1)

(ii) Calculate the distance of the moth from the bat. (Give the unit.)

.....

.....

..... (3)

(d) Give one advantage and one disadvantage of using this method for finding prey.

advantage: .....

.....

disadvantage: .....

..... (2)

A device for stopping cats entering a garden emits a loud high-pitched sound when it detects movement.

The manufacturers of the device claim that it cannot be heard by dogs.

(e) Suggest and explain a suitable frequency for the sound emitted by the device.

.....

.....

..... (2)

5. Matthew has a piece of metal which he thinks may be a magnet.

He also has a small permanent magnet.

(a) Describe how he could test the metal to see if it is a magnet.

.....

..... (2)

(b) His test shows that his piece of metal is a magnet.

Describe how he might find out which pole is the north-seeking pole.

.....

.....

..... (2)

6. The diagram below shows the positions of the Earth and Venus at one moment in their orbits.

not to scale

(a) Name the body, **A**, at the centre of these orbits.

..... (1)

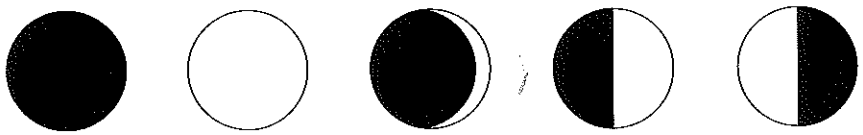
(b) Venus is not a luminous object but it is often visible from Earth.
Explain how it is possible to see Venus from Earth.

.....

..... (2)

(c) On the diagram above, shade the part of Venus which would be in the dark. (1)

(d) If Venus and Earth are in the positions shown above, underline the diagram below which best shows how Venus would appear to an observer on Earth.



(1)

Atmospheric pressure on the surface of Venus is about 90 N / cm^2.

A camera sent to photograph the surface of Venus would have to be strong enough to withstand this pressure.

(e) (i) Write down the equation which relates area, force and pressure.

..... (1)

(ii) Use this equation to calculate the force which the atmosphere would exert on the lens of the camera if it had an area of 6 cm^2. *(Give the unit.)*

.....

..... (2)

7. Many electricity power stations are built far away from where the energy is needed.

(a) (i) List two non-renewable energy resources which can be used for generating electricity.

1: .....

2: ..... (2)

(ii) List two renewable energy resources which can be used for generating electricity.

1: .....

2: ..... (2)

(b) Suggest a reason why power stations are often built far away from where the electrical energy is needed.

.....

.....

..... (1)

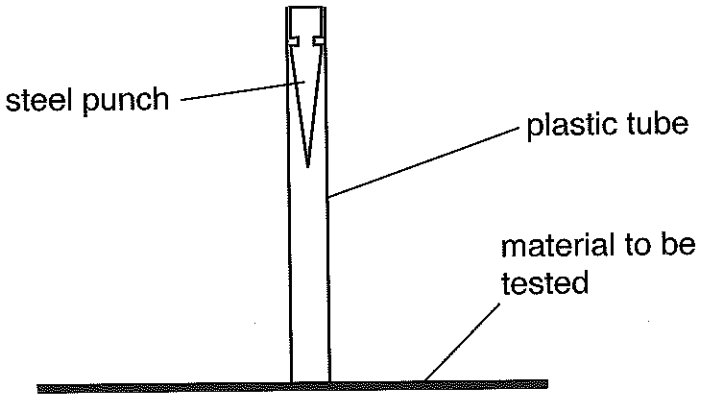
One of the problems of having to transmit electrical energy over a long distance is that the wires used have resistance.

This causes energy to be wasted.

(c) In what form is this energy wasted? ..... (1)

8. A student wanted to investigate the hardness of different materials.

She set up the following equipment:



She decided to drop a sharp steel punch from the same height onto different materials and to measure the diameter of the mark in each material.

(a) Why is it important to drop the punch from the same height each time?

.....

..... (2)

(b) The plastic tube helps her drop the punch from the same height each time.

Suggest another sensible reason for using it.

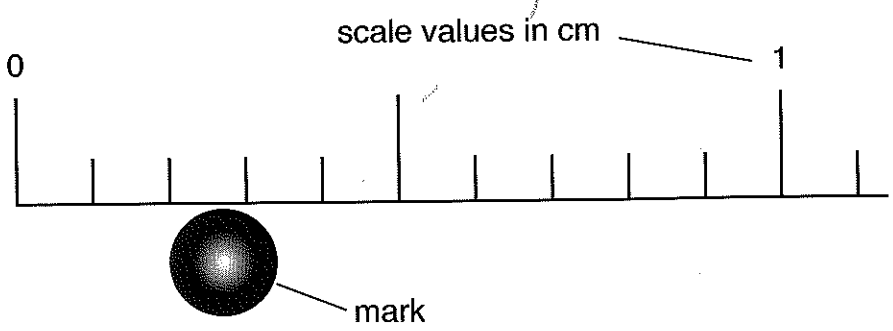
.....

..... (1)

To measure the diameter of the mark made in the material, she placed a ruler beside it and looked at it through a microscope.

This magnified the image 10 times.

The diagram shows what she saw when looking at one of the marks.



(c) (i) Estimate the diameter of the mark shown as accurately as you can. *(Give the unit.)*

..... (3)

(ii) What is the advantage of using a microscope to help her to measure the diameter of the mark?

..... (1)

She obtained the following results:

material	diameter of mark, in mm	hardness
oak	1.7	
copper	0.8	
steel	0.1	
polythene	1.4	
aluminium	1.0	
pine	2.0	

(d) Add numbers to the hardness column, putting 1 for the material which is the hardest, 2 for the next hardest etc. for all six materials. (3)

She suggests that the results for polythene, aluminium and pine may be unreliable because they have been tested after the steel.

(e) (i) Explain why this suggestion is sensible.

.....

..... (1)

(ii) Explain what she could do to see if her test is reliable.

.....

.....

..... (2)

(Total marks: 60)