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

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

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

PHYSICS

Wednesday 9 June 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.

28310332

© Independent Schools Examinations Board

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

(a) A material which is a good conductor of electricity is

copper **paper** **plastic** **wood**

(b) When a car brakes, most of the kinetic energy of the car is transformed into

friction **light** **sound** **thermal energy**

(c) The Milky Way is a

galaxy **satellite** **star** **universe**

(d) In order to keep moving at a constant speed, a car must have

a force acting downwards on it

an increasing force acting on it

an unbalanced force acting on it

balanced forces acting on it

(e) The position of the Sun in the sky appears to change during the day.
This is because

the Earth moves round the Sun

the Earth rotates once every day

the Sun moves round the Earth

the Sun rotates once every day

(f) A piano tuner repeatedly presses one key on a piano.
While he does this, he tightens the piano string which is being struck, causing the frequency of vibration of the string to increase.
This will cause the note to

become louder **decrease in pitch**

increase in amplitude **increase in pitch**

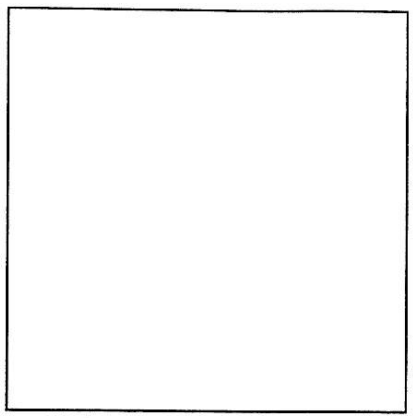
(6)

2. A pupil is given a sealed box and told that it contains two bar magnets which are fixed inside it.

She wants to find out how the magnets are arranged inside the box.

To do this, she sprinkles iron filings round the box.

The pattern she obtains is shown in the diagram below.



(a) On the diagram, draw how you think the two bar magnets may be arranged inside the box.

Mark their poles clearly. (2)

She cannot tell from the iron-filing pattern which ends of the bar magnets are north-seeking and which are south-seeking.

(b) (i) State the piece of equipment she could use which would enable her to discover this.

..... (1)

(ii) Explain how she might use this to identify the correct arrangement of the poles of the magnets.

(You may draw on the diagram if it helps.)

.....

.....

..... (3)

3. A famous (and unsuccessful) experiment to measure the speed of light was proposed by Galileo in 1638.

With the help of an assistant, he tried to time how long it took a flash of light from a lantern to travel between two mountain tops about 1500 m apart.

(a) Suggest a reason why the experiment was unsuccessful.

.....

..... (2)

(b) Suggest and explain what would be observed if a similar experiment were to be carried out with a loud bang at the same time as the flash of light.

suggestion: .....

explanation: ..... (2)

The speed of sound is about 300 m/s.

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

..... (1)

(ii) Calculate the time it would take for the sound to travel between the two mountain tops. Give the correct unit.

.....

..... (3)

Galileo's experiment can be carried out now using a flash of light from a bright LED.

The flash is detected by an electronic detector and timer.

(d) Using the correct circuit symbols, draw a circuit in the space below to allow the LED to be flashed. Your circuit should include a battery, the LED and a push-button switch. (2)

(e) A possible arrangement for the experiment is shown in the diagram below.

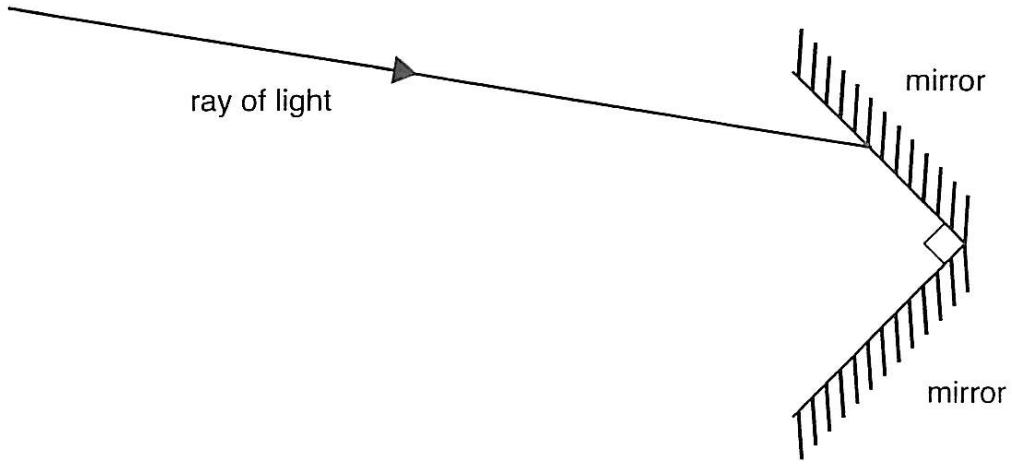
Draw a ray of light from the light source to the mirror and back to the detector. (1)



Knowing the speed of light allows scientists to measure the distance between the Earth and the Moon very accurately.

The Apollo 11 astronauts left a special reflector on the Moon to help with this measurement.

It consists of mirrors mounted at right angles to each other, as shown below.



(f) Complete the path of the ray of light on the diagram to show how it reflects from the two mirrors. (2)

(g) The astronauts could have left a single mirror on the Moon. Suggest why it was more sensible for them to leave this arrangement of two mirrors.

.....

.....

..... (2)

4. Matthew decides that he will cycle to and from school each day.

His school is 5 km from his home.

(a) Calculate the total distance cycled to and from school each five-day week.

..... (1)

The school year is 37 weeks.

(b) Show that the total distance he cycles to and from school in one year is 1850 km.

..... (1)

If Matthew did not cycle, his father would have to drive to school and back home twice per day.

To do this, he would drive a total distance of 3700 km.

His car uses 9 litres of petrol to go 100 km.

(c) Calculate the amount of petrol saved in a year by Matthew cycling to school.

.....

.....

..... (2)

The car emits 0.22 g of carbon dioxide per kilometre.

(d) Show that the amount of carbon dioxide emitted into the atmosphere as a result of Matthew cycling is reduced by about 0.8 kg per year.

.....

.....

..... (2)

(e) Suggest and explain any two reasons why Matthew's decision to cycle to school could be beneficial.

reason 1: .....

.....

explanation 1: .....

..... (2)

reason 2: .....

.....

explanation 2: .....

..... (2)

5. Some data about the planets in our solar system is given in the table below.
Use the data to help you answer the questions.

planet	distance from Sun, in astronomical units	time for one orbit, in years	time to rotate once, in days
Earth	1.00	1.00	1.00
Jupiter	5.20	11.9	0.41
Mars	1.52	1.88	1.03
Mercury	0.39	0.24	58.7
Saturn	9.53	29.5	0.43
Venus	0.72	0.62	−243

(a) Which of the planets in the table above takes longest to orbit the Sun?

..... (1)

(b) State and explain which of the planets is likely to have the highest average surface temperature.

.....

.....

..... (2)

(c) Which planet has the shortest day? ..... (1)

Five of the planets in the table have a positive rotation period but the rotation period of Venus is given as −243 days.

(d) Suggest a reason for the negative sign in this piece of data.

.....

..... (1)

Titan is the largest moon of Saturn and is thought to be one of the few places in the solar system, other than Earth, to contain water.

Any water on Titan will be frozen.

(e) (i) What is a moon? .....

..... (1)

(ii) Suggest why any water on Titan is likely to be frozen.

.....

..... (1)

6. Jonathan and his friend want to measure the density of some common building materials.

They have the following items: some gravel, a block of wood, a brick.

(a) State the equation which relates density, mass and volume.

..... (1)

To measure the density of gravel, they decide they need a measuring cylinder, some water and a balance.

(b) Describe how they might use the measuring cylinder and water to find the volume of some gravel.

(You may use a diagram if it helps.)

.....

.....

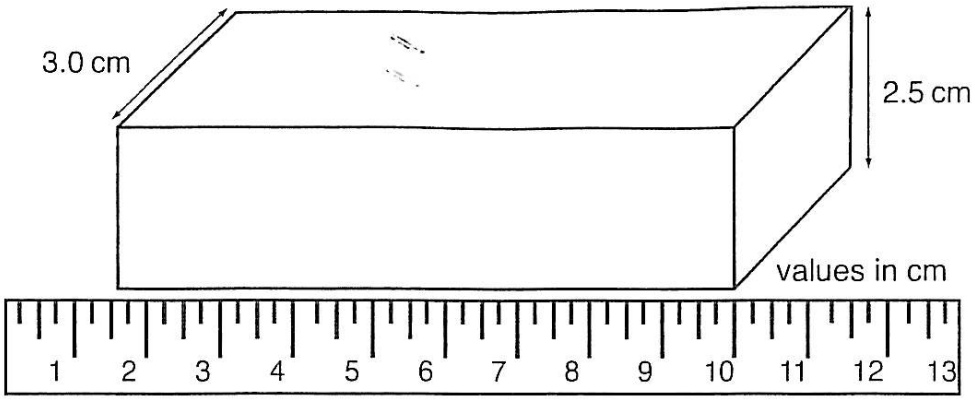
.....

..... (3)

(c) State another measurement which they need to make in order to calculate the density of the gravel.

..... (1)

Jonathan and his friend now measure the wooden block.
Its width and height are shown in the picture below.



(d) Write down the length of the block using the ruler in the picture.
Give the unit.

..... (2)

(e) Show that the volume of the block is about 63 cm^3.

.....

.....

..... (2)

The mass of the block is 44.1 g.

(f) Calculate the density of the wood.
Give the correct unit.

.....

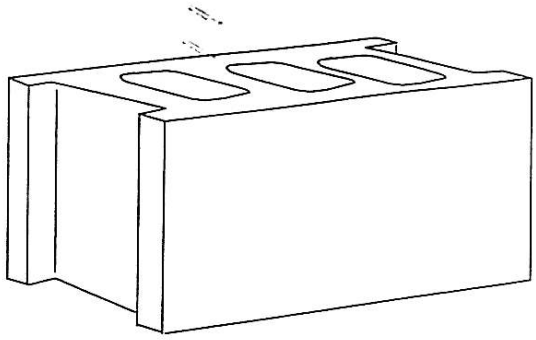
.....

..... (3)

Next, they want to measure the density of the brick.

They decide to measure the volume of the brick by putting it in water.

Bricks are porous.



(g) State and explain one advantage and one disadvantage of measuring the volume of the brick by this method.

advantage: .....

.....

.....

..... (2)

disadvantage: .....

.....

.....

..... (2)

(Total marks: 60)