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

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

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

LEVEL 2

PHYSICS

Wednesday 29 January 2014

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.

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

(a) Chemical energy is converted to light energy by

a battery **a candle**

a light-emitting diode **a microphone**

(b) An eclipse of the Sun occurs when

it is a leap year

the Earth lies between the Sun and the Moon

the Moon lies between the Sun and the Earth

the Sun lies between the Earth and the Moon

(c) A rainbow is caused by

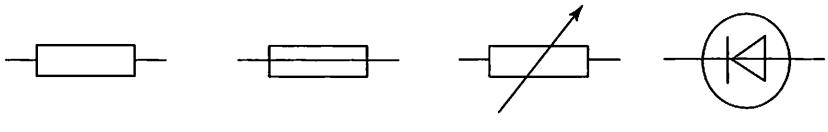
light from our eyes being refracted by raindrops

sunlight being dispersed by passing through raindrops

sunlight being reflected from the sky

sunlight being reflected from the surface of raindrops

(d) The symbol for a fuse is



(e) An energy resource which is non-renewable is

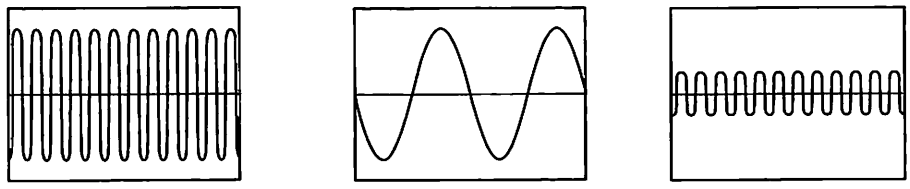
biomass **coal** **solar** **wind**

(f) The speed of a moving object will always stay the same if

all forces on it are balanced **it is in a vacuum**

there is a constant force on it **there is no gravity** (6)

2. Gregory plays the bass guitar near a microphone.
The pattern of the sound waves is displayed on a screen.
The diagrams below show the patterns made by three sounds.

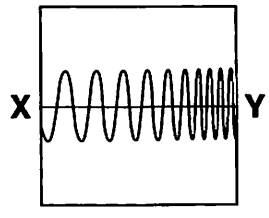


(a) (i) State which two sounds have the same loudness.

..... (1)

(ii) Explain how the patterns show this.

..... (1)



Gregory plays a sound on his guitar which produces the pattern shown above.

(b) (i) Does the pitch of the sound change from **X** to **Y**?

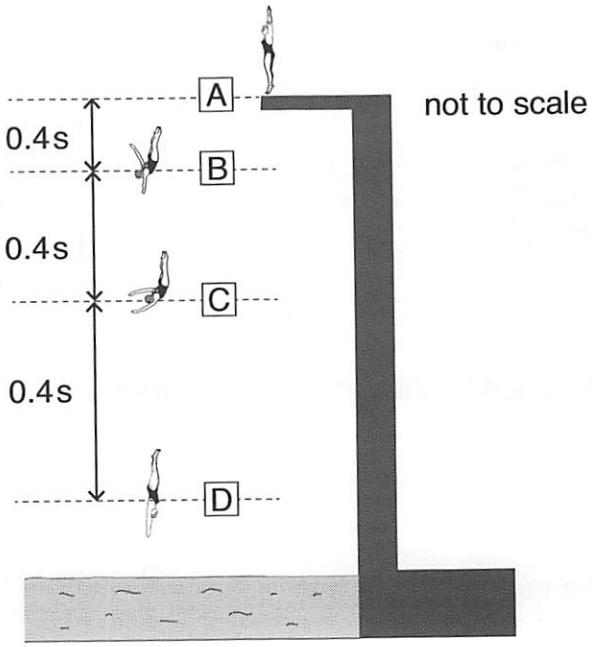
..... (1)

(ii) Explain how the pattern shows this.

.....

..... (1)

3. The drawings below show Sarah diving into a swimming pool.



At point A, Sarah has NO kinetic energy.

(a) Explain why.

..... (1)

The table below shows Sarah's gravitational potential energy and kinetic energy at four stages of the dive.

stage of dive	total energy, in J	gravitational potential energy, in J	kinetic energy, in J
A	6000	6000	0
B	6000	5520	480
C	6000	4080	1920
D	6000	1680	

(b) Write the kinetic energy value for stage D in the table. (1)

As Sarah falls there is no loss of energy to the air.

(c) Explain how the data in the table shows this.

..... (1)

(d) Name the force which makes Sarah speed up as she falls.

..... (1)

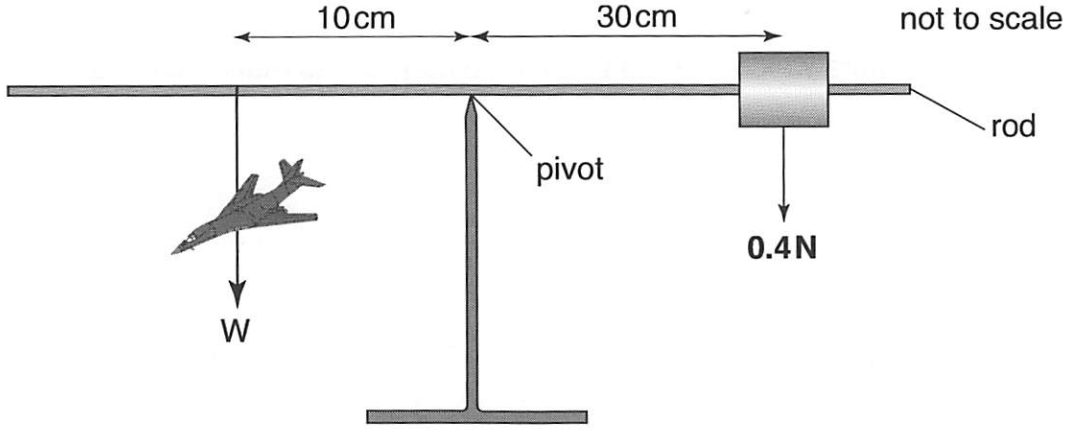
(e) How can you tell from the diagram that she is speeding up as she falls?

..... (1)

(f) Name the force which slows her down when she enters the water.

..... (1)

4. Dan has a model plane attached to a rod as shown below.



The rod is balanced horizontally on a pivot by a 0.4 N weight.

(a) Use information from the diagram to calculate the moment of the 0.4 N weight about the pivot.

Give the unit.

.....

..... unit ..... (3)

(b) Calculate the weight of the model plane in newtons.

.....

..... weight = ... N (2)

5. Conrad is given three wires made of different materials but all with the same diameter.
He wants to find out which of the materials has the lowest electrical resistance.
To do this, he connects each wire (one at a time) in a circuit with a cell and an ammeter.

(a) Draw a suitable circuit diagram below, using the correct circuit symbols.
You should use the symbol for a resistor to represent the wire being tested.

(2)

(b) State TWO factors which Conrad must keep constant to make this a fair test.

1: .....

2: ..... (2)

(c) Explain how he can use the results of his experiment to compare the electrical resistance of the three wires.

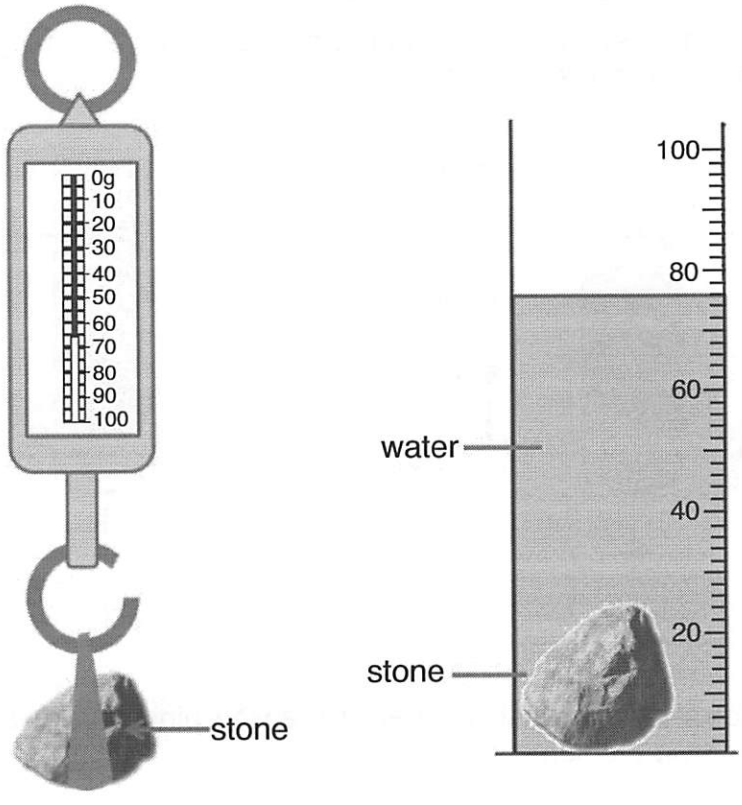
.....

.....

.....

..... (2)

6. The diagram shows a balance used to measure mass in grams.



(a) State the mass of the stone.

..... (1)

50 cm^3 of water was put in the measuring cylinder.
The stone was then placed in the water as shown.

(b) Calculate the volume of the stone.

..... volume = ... cm^3 (1)

(c) (i) State the relationship between density, mass and volume.

..... (1)

(ii) Calculate the density of the stone. Give the unit.

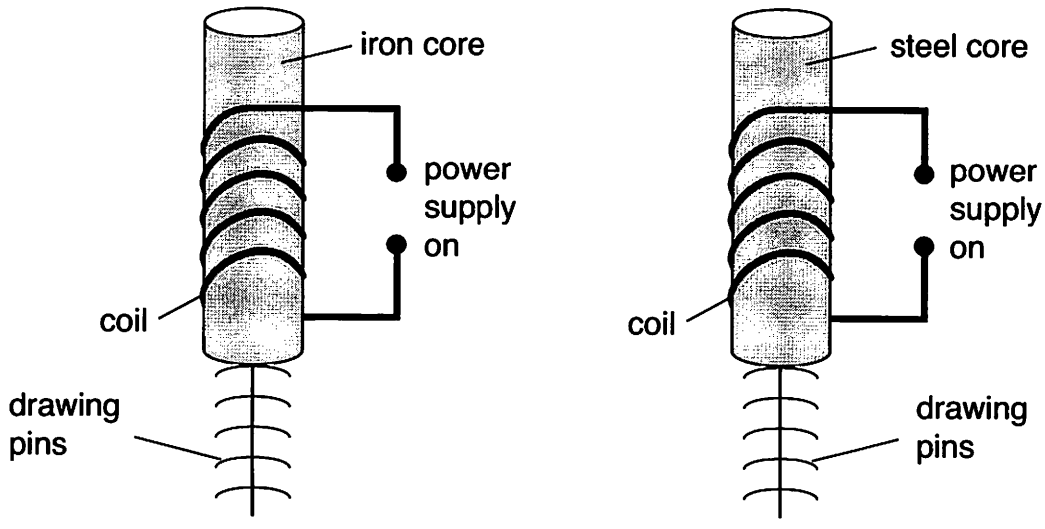
.....

..... unit ..... (2)

7. Katie made two electromagnets, one with an iron core and the other with a steel core.

She switched on the power supply in both circuits.

To test the strength of each electromagnet, she attached as many drawing pins as possible (in a chain), as shown below.



The diagram shows the greatest number of drawing pins which each electromagnet could hold when using the same current.

(a) (i) State whether or not you think the electromagnets have the same strength.

..... (1)

(ii) Explain why you think this.

.....

..... (1)

Katie switched off both power supplies.

(b) State and explain what will happen to the drawing pins attached to each core.

iron core: .....

.....

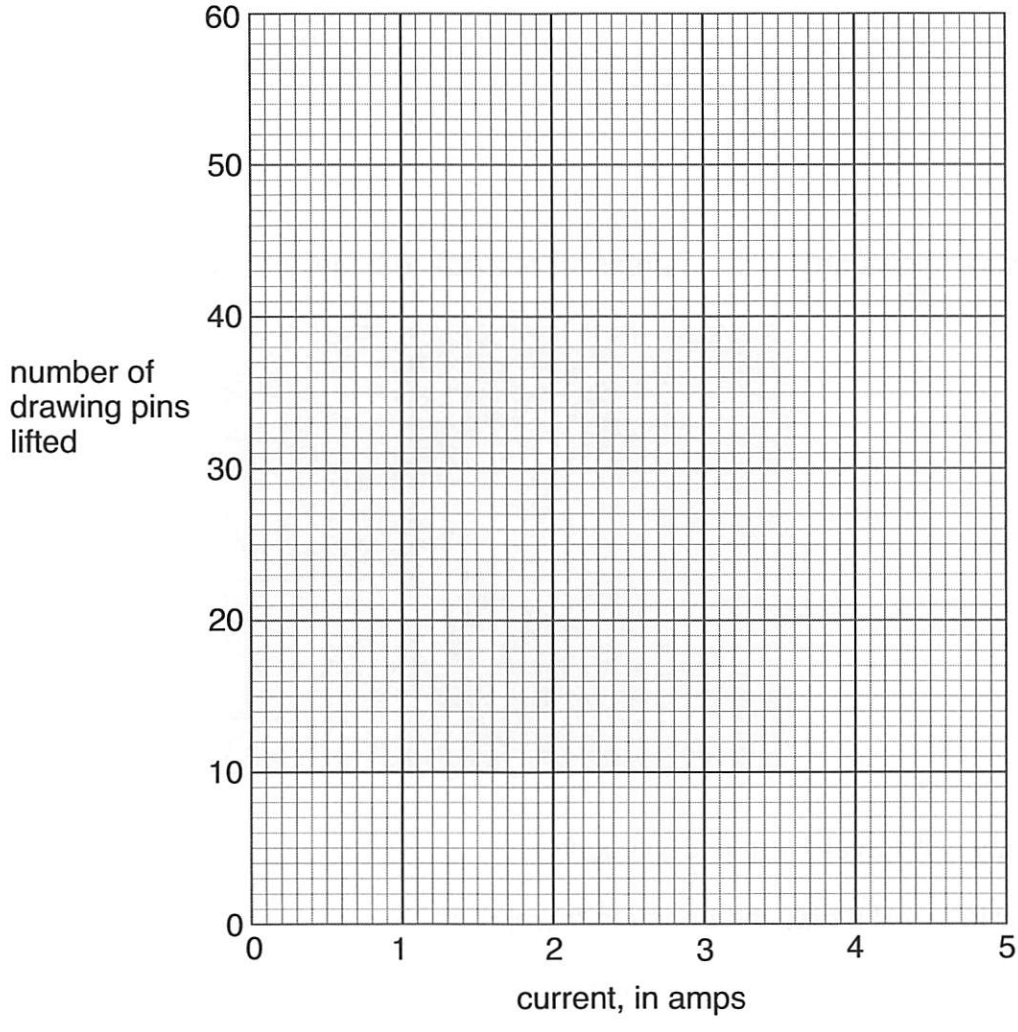
steel core: .....

.....

..... (3)

Katie then used the electromagnet with the iron core.
She investigated how its strength depended on the current in the coil.
She counted the number of drawing pins that it could lift using various different currents.
Here are her results:

current, in amps	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
number of pins lifted	0	2	8	20	34	44	52	56	56



(c) (i) Plot the results on the grid above. (2)

(ii) Draw the line or curve of best fit on the graph. (1)

(d) Describe how the strength of the electromagnet depends on the current.

.....

.....

..... (2)

(e) Suggest a reason why there seems to be a limit to the number of drawing pins which the electromagnet can lift.

.....

..... (1)

(f) Suggest how Katie could get an electromagnet to lift a chain of 56 of her drawing pins using a current of only 1 amp.

.....

..... (1)

8. This picture shows an artist's impression of a space buggy on the planet Mars.

The buggy can travel 1.2 m in 30 seconds.

(a) How long will it take the buggy to travel 60 m?

.....

..... (2)

The weight of the buggy is 900 N on Earth, but 340 N on Mars.

(b) Explain why the buggy has less weight on Mars than it does on Earth.

.....

..... (2)

The buggy's small weight means that it can travel over soft sand on Mars without sinking in too far.

(c) State and explain another reason why the buggy does not sink in too far when it travels over soft sand.

reason: ..... (1)

explanation: .....

.....

..... (2)

The buggy uses solar panels to generate electrical energy.

The solar panels generate less electrical energy on Mars than they do on Earth, even in full sunlight.

(d) Explain why.

.....

.....

.....

..... (2)

TURN OVER FOR QUESTION 9

9. The diagram below shows a fish tank.

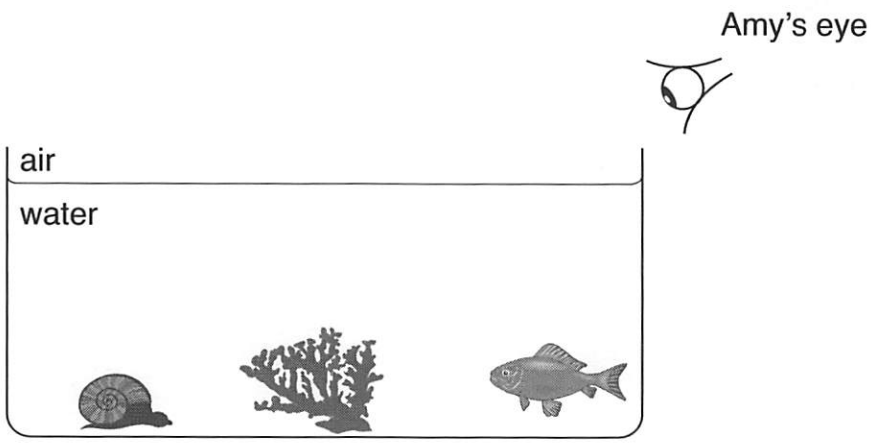
The surface of the water acts like a mirror to the fish.

The fish can see the snail reflected in the surface of the water.

(a) (i) Draw a ray of light on the diagram above to show how the fish can see the snail. (2)

(ii) Show and label the angle of incidence on your diagram. (2)

The diagram below shows Amy looking at the snail.



In order for Amy to see the snail, a ray of light must travel from the snail to her eye.

This light ray changes direction when it goes from the water into the air.

(b) (i) Draw this ray of light on the diagram. (2)

(ii) State the scientific name for the change of direction of the light ray.

..... (1)

(Total marks: 60)