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Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

BIOLOGY

Monday 27 February 2006

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 word or phrase which best completes each of the following sentences.

(a) Respiration releases

energy glucose oxygen starch.

(b) An example of a human organ is

blood a nerve cell a sperm the heart.

(c) The disease which is caused by lack of calcium is

cold rickets scurvy tuberculosis.

(d) In digestion, enzymes

break down large food molecules kill bacteria

cause the intestine walls to contract make the gut acidic.

(e) The nutrients used for growth and repair are

carbohydrates fats proteins vitamins.

(f) A green plant is an example of a

carnivore consumer predator producer.

(g) In plant cells, most DNA is found in the

cell membrane cell wall cytoplasm nucleus.

(h) Animals

photosynthesise have cellulose cell walls

move around reproduce with seeds.

(i) Plants absorb light energy with

cellulose chlorophyll glucose starch.

(j) Oxygen moves from the lungs to the blood across the

alveoli **diaphragm** **nostril** **windpipe.**

(10)

2. When Maurice runs, his muscle cells need energy to contract.

(a) How do Maurice's muscle cells get the energy they need to contract?

.....

.....

..... (3)

(b) A good supply of blood flows past Maurice's muscle cells. Explain how this helps Maurice's muscles to contract.

.....

.....

..... (3)

(c) Maurice's muscles make carbon dioxide when they contract. Describe what happens to the carbon dioxide.

.....

.....

..... (3)

(d) In Maurice's legs, muscles are arranged in antagonistic pairs. Explain how antagonistic muscles help Maurice to run.

.....

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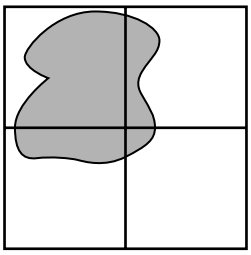
..... (3)

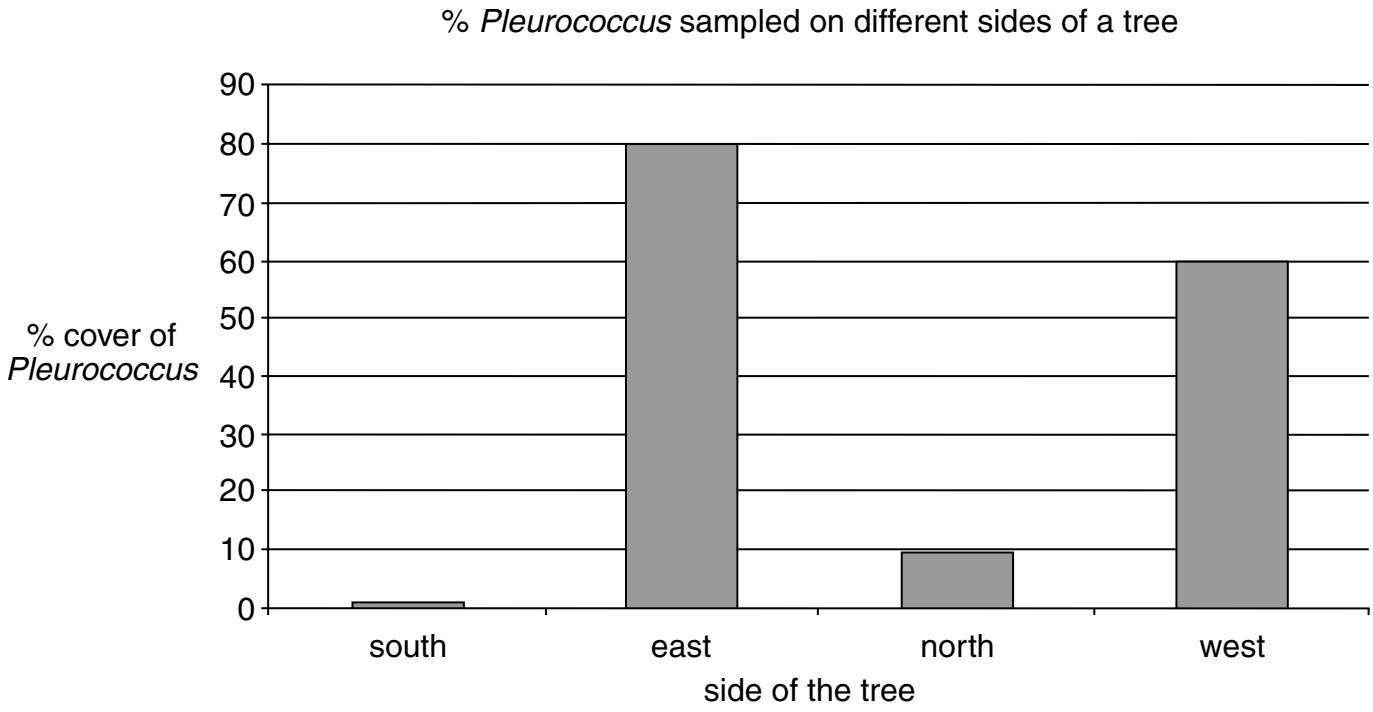
3. Ali and Thomas decided to study the growth of a green organism called *Pleurococcus* which grows on the surfaces of trees. They placed a small plastic quadrat on the tree at different heights and estimated the percentage of the quadrat covered by *Pleurococcus*.



(a) Estimate the % of the quadrat covered by *Pleurococcus*.

..... (1)

Ali and Thomas did this on the four sides of the tree. They used a compass to determine which direction each of the sides was facing.



(b) Describe how the distribution of *Pleurococcus* varies with direction.

.....

..... (2)

Ali and Thomas also collected measurements of the amount of rainwater running off each surface of the tree and the intensity of light falling on each surface of the tree. Their results are shown below.

direction	rainwater running off tree in cm^3/week	light intensity in light intensity units
south	0.5	100
east	3.0	90
north	0.5	90
west	2.0	85

Pleurococcus is a small single-celled plant which does not have roots or leaves.

(c) Which one of the two factors, water availability or light intensity, is likely to have the bigger influence on the growth of the *Pleurococcus*? Explain your answer.

factor: ..... (1)

explanation: .....

.....

.....

..... (3)

Pleurococcus contains chlorophyll.

(d) Explain how *Pleurococcus* feeds.

.....

.....

.....

.....

..... (3)

4. White bread contains a lot of starch.

(a) Describe carefully how you could show that the bread contains starch.

.....

.....

.....

..... (3)

Robert chews a piece of white bread for a few minutes without swallowing it. He says that after a while it becomes wet and starts to taste sweet.

(b) Explain what is happening to the bread in Robert's mouth.

.....

.....

..... (3)

Wholemeal bread, which is made from all of the wheat grain, is thought to be healthier than white bread because it provides fibre for the diet.

(c) Explain why fibre is an essential part of our diet.

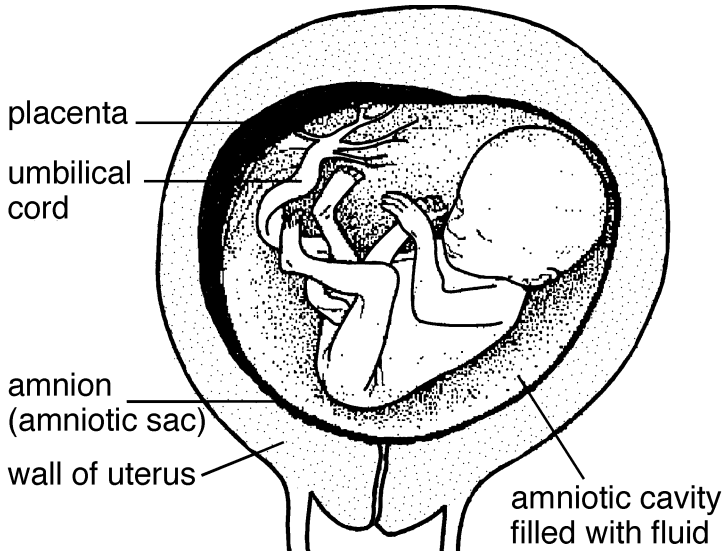
.....

.....

.....

..... (3)

5. The picture shows how a fetus is protected and nourished whilst in the uterus.



The fetus is surrounded by a liquid called **amniotic fluid**.

(a) Explain how amniotic fluid protects the fetus during development.

.....

..... (2)

Just before a baby is born, the amnion breaks and the amniotic fluid is forced out of the vagina. This is called the **breaking of the waters**.

(b) What causes the amnion to break?

.....

..... (2)

The baby is connected to the placenta by the umbilical cord.

(c) Describe and explain how the placenta nourishes the fetus during its time in the uterus.

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.....

.....

..... (4)

(d) What does the midwife or doctor do to the umbilical cord as soon as the baby is born? Suggest a reason for this.

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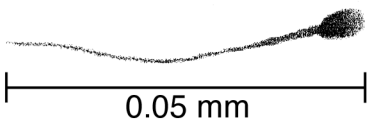
.....

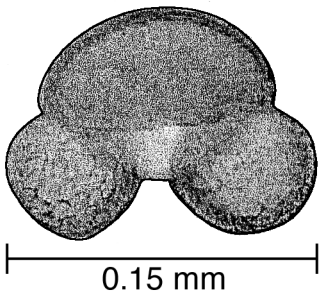
..... (2)

6. The diagram below shows a sperm cell and a pollen grain.

sperm cell



pollen grain



(a) Which is the larger structure?

..... (1)

(b) Below is a table showing some characteristics of sperm cells and pollen grains. Some characteristics are shared by both sperm cells and pollen grains. Write 'sperm', or 'pollen' or 'both' next to each of the characteristics.

characteristic	sperm, pollen or both
contains genes and DNA	
swims to the egg	
produces a tube	
contains cytoplasm	

(4)

7. Kevin eats his breakfast cereal with a spoon which has just been used by his brother. He then strokes his pet hamster, Boris, at the same time as he eats a jam sandwich. He then goes to the lavatory and leaves for school without cleaning his teeth or washing his hands. On his way to school he sneezes in the bus, but he does not have a handkerchief.

   Explain to Kevin how he can live a healthier life. Give reasons for your suggestions.

   .....

   .....

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   .....

   ..... (4)

(Total marks: 60)

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Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

CHEMISTRY

Tuesday 28 February 2006

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 word, phrase or number which best completes each of the following sentences.

(a) The element iron contains

iron and oxygen atoms **iron and oxygen molecules**

only iron atoms **only iron molecules.**

(b) The compound iron sulphide contains

a mixture of iron atoms and sulphur atoms

a mixture of iron atoms and sulphur molecules

iron and sulphur atoms which have reacted together

iron sulphide atoms.

(c) The number of chemical elements is

about 10 **about 100** **about 1000** **many millions.**

(d) An element which is an insulator is

copper **lead** **sulphur** **tin.**

(e) An element which is malleable is

carbon **nitrogen** **sulphur** **zinc.**

(f) An element which forms an acidic oxide is

copper **iron** **sodium** **sulphur.**

(g) 24 g of magnesium combine with 16 g of oxygen to form 40 g of magnesium oxide.

120 g of magnesium oxide is a combination of

64 g of magnesium and 56 g of oxygen

72 g of magnesium and 48 g of oxygen

80 g of magnesium and 40 g of oxygen

100 g of magnesium and 20 g of oxygen.

(h) A liquid which is a compound and not a mixture is

ethanol **milk** **petrol** **sea water.** (8)

2. Fill in the blanks in the passage below, using each of these words only once.

boils **condenses** **dissolves**

evaporates **freezes** **melts**

When ice is warmed, it ..... and becomes water; on further heating, the water ..... and becomes steam. When the steam is cooled, it ..... to form water again; when really cold, the water ..... and becomes ice again.

If salt is stirred into water, the salt ..... to form a solution.

Salt crystals form when the water ..... .

(6)

3. (a) When sulphur burns, oxygen is used up and the sulphur disappears. What has happened?

..... (2)

(b) We use up oxygen when we breathe. Which two compounds are formed?

1 ..... (1)

2 ..... (1)

(c) What percentage of normal air is oxygen?

..... (1)

(d) How would you test for oxygen?

.....

..... (2)

(e) Give the name of the process which restores oxygen to the atmosphere.

..... (1)

4. Many foodstuffs are acidic (lemon pH = 2.5; apple pH = 3.5), but the process of digestion in the stomach involves even more acidic conditions. Indigestion is usually the result of too much acid, which can be treated using a suitable alkali, such as milk of magnesia (magnesium hydroxide suspension; pH = 8.5).

(a) Suggest a pH value for the acid in the stomach.

..... (1)

(b) What name is given to reactions in which an acid reacts with an alkali?

..... (1)

(c) Assuming that stomach acid is hydrochloric acid, complete the word equation for its reaction with magnesium hydroxide.

hydrochloric acid ..... + ⟶ + magnesium hydroxide ..... (3)

(d) Suggest why limewater (pH = 12) is not used for treating indigestion.

.....

..... (2)

(e) Solid calcium carbonate can be used to treat indigestion. Which gas forms when it reacts with the stomach acid?

..... (1)

(f) Explain what is meant by a **suspension** of magnesium hydroxide.

.....

..... (2)

(g) What would you expect to happen to the temperature when an acid reacts with an alkali? Explain your answer.

.....

..... (2)

(h) When an acid reacts with an alkali, what would you expect to happen to the total mass? Explain your answer.

.....

..... (2)

5. Acids, such as sulphuric acid, will react with some metals to give hydrogen gas.

(a) Draw a diagram of the apparatus you could use to collect a sample of hydrogen, labelling the acid, the metal and the hydrogen.

(5)

The following data apply to five different metals which might be used in (a).

name	description	volume of hydrogen produced from 1 kilogram of metal, in m^3	price of metal, in £ per kilogram
aluminium	thick foil	1.3	55
copper	small turnings	none	18
iron	powder	0.4	3
magnesium	ribbon	1.0	230
zinc	small lumps	0.4	11

(b) Why does copper give no hydrogen?

.....

..... (2)

(c) The aluminium releases the hydrogen very slowly. One way to speed up the rate of reaction would be to increase the concentration of the acid. Give two other ways.

1 ..... (1)

2 ..... (1)

(d) Either of the ways in (c) could result in the reaction becoming hazardous. For one of these ways, explain the hazard and state what you could do to minimise it.

.....

.....

.....

..... (2)

(e) Which metal gives the most hydrogen per kilogram?

..... (1)

(f) You wish to make hydrogen as cheaply as possible. Explain which metal you would choose.

.....

.....

..... (2)

(g) Why do you think that magnesium is the most expensive metal?

.....

..... (2)

6. Here is some information about four colourless liquids, **A**, **B**, **C** and **D**.
What can you deduce about each of them?

(a) **A** boiled at 100 °C and turned blue cobalt chloride pink.

.....

.....

..... (2)

(b) **B** boiled at 104 °C and turned blue cobalt chloride pink.

.....

.....

..... (2)

(c) **C** boiled at 100 °C and did not turn blue cobalt chloride pink.

.....

.....

..... (2)

(d) **D** froze at 0 °C and turned white copper sulphate blue.

.....

.....

..... (2)

(Total marks: 60)

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Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

PHYSICS

Wednesday 1 March 2006

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 number, word or phrase which best completes each of the following sentences.

(a) The mass of this examination paper is most likely to be

3 g **30 g** **300 g** **3 000 g.**

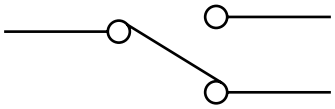
(b) If the particles in a substance are arranged in a regular pattern, it is likely to be a

gas **liquid** **solid** **vacuum.**

(c) A planet whose distance from the Sun is less than that of the Earth is

Mars **Jupiter** **Saturn** **Venus.**

(d) The type of switch denoted by this symbol is

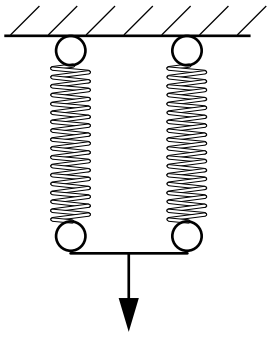


push **relay** **SPDT** **SPST.**

(e) A unit used for measuring the kinetic energy of a car is

hertz **joule** **km/h** **newton.**

(f) When two springs are hung up as shown,



they are said to be in

line **opposition** **parallel** **series.**

(g) We know that Mars is a planet because it

can be seen at night with the naked eye

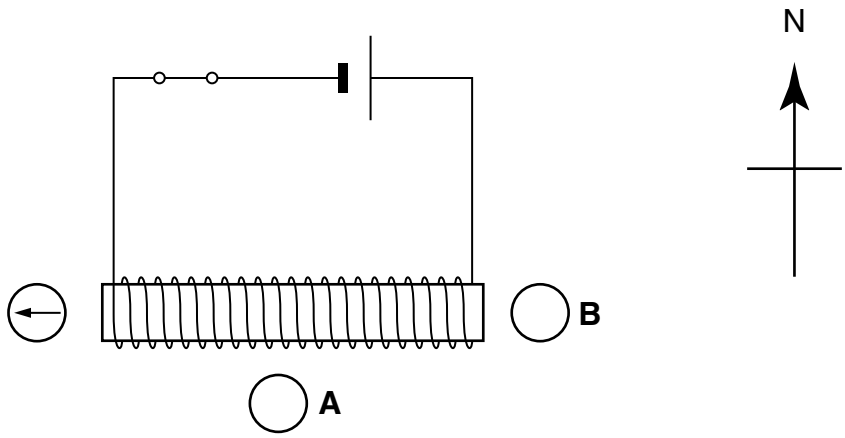
can be seen in detail through a telescope

orbits the Sun

reflects light from the Sun.

(7)

2. The diagram shows a length of copper wire coiled round a wooden rod. Three compasses are placed round the rod as shown.



(a) Draw arrows on the compasses labelled **A** and **B** to show the direction of the magnetic field at those places. (2)

(b) If the switch in the circuit is opened, what will happen to the needle on compasses **A** and **B**?

.....

..... (2)

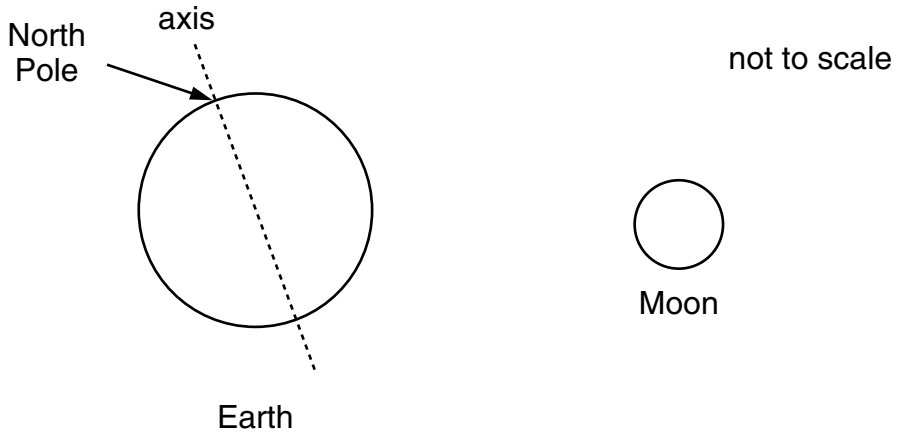
(c) Write down one way to reverse the direction of the magnetic field.

..... (1)

(d) Write down one way to increase the strength of the magnetic field.

..... (1)

3. The diagram shows the Earth and the Moon during an eclipse of the Moon.



(a) Draw on the diagram the position of the Sun. (1)

(b) (i) Shade in on the diagram the part of the Earth which is in darkness at this time. (1)

(ii) Explain why this part of the Earth does not stay in darkness all the time.

.....

..... (1)

(c) In the position shown, is it winter or summer in the northern half of the Earth?

..... (1)

How can you tell?

..... (1)

4. Phil and Sally are trying to measure the thickness of a single sheet of paper. They both use the same apparatus. Phil uses a pile of 10 sheets; Sally uses a pile of 100 sheets.

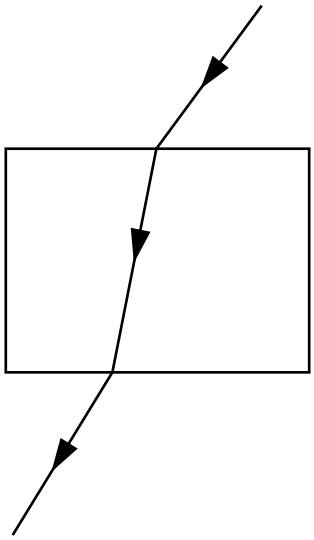
Give a reason why Sally's answer may be more accurate than Phil's.

.....

.....

..... (2)

5. The diagram shows a ray of blue light passing through a glass block.

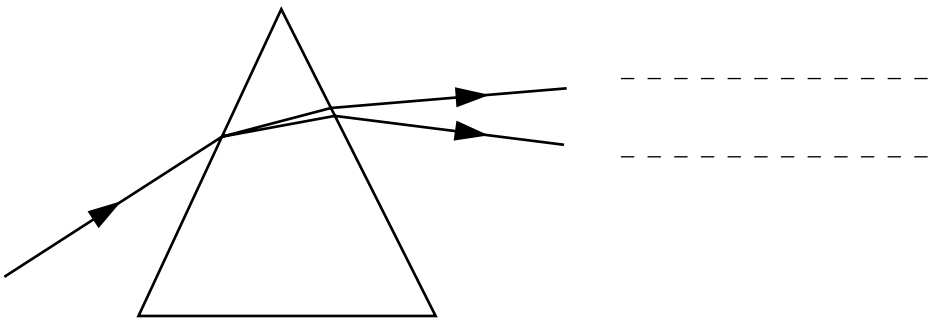


(a) When the light enters the glass block, it changes direction. What name is given to this effect?

..... (1)

(b) On the diagram above, draw in the path of the light which would be reflected from the first surface of the block. (2)

(c) The diagram shows a ray of white light passing through a prism.



The prism splits the light into several colours. The two extreme ends are shown. Write beside each of these rays which colour it **could** be. (3)

6. Tim is walking along the cliffs beside a golf course. He watches a golfer hit the ball and he hears the sound of the club hitting the ball a fraction of a second after he sees the club hit the ball.

(a) Explain why.

.....

..... (2)

Tim watches the player hit the ball again; he estimates that the ball is travelling 100 m in 2.5 s.

(b) Calculate the average speed of the ball in m/s.

.....

.....

..... (2)

The ball is hit upwards. When it falls back to the flat fairway, it rolls to a halt.

(c) (i) Which form of energy allows the golfer to hit the ball?

..... (1)

(ii) Which form of energy does the ball gain as it rises into the air?

..... (1)

(iii) Into which form of energy is most of this transferred as the ball falls?

..... (1)

(iv) The energy of the ball is transferred into various forms as the ball hits the ground. Name two of these forms.

1 ..... (1)

2 ..... (1)

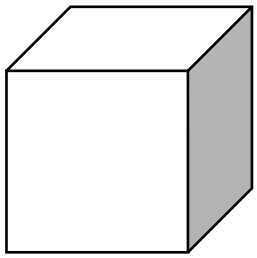
(d) (i) Which force causes the ball to fall to the ground?

..... (1)

(ii) Which force causes the ball to come to a halt?

..... (1)

7. Each edge of this cube measures 20 cm.



(a) Calculate the volume of the cube in cm^3.

.....

..... (2)

(b) The mass of the cube is 9.6 kg. Show that its density is 1.2 g/cm^3.

.....

.....

.....

..... (3)

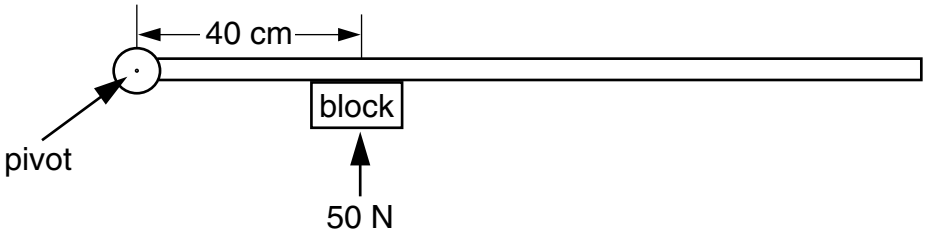
(c) Water has a density of 1.0 g/cm^3. Will the cube float or sink if it is placed in water? Explain your answer.

answer: ..... (1)

reason: .....

..... (1)

8. The diagram shows a plank pivoted at one end, resting on a block. Someone is pushing upwards with a force of 50 N on the block.



(a) Calculate the moment of the 50 N force about the pivot.

.....

.....

..... (3)

The 50 N force is exerted over an area of 25 cm^2 of the block.

(b) Calculate the pressure which the force is exerting on the block.

.....

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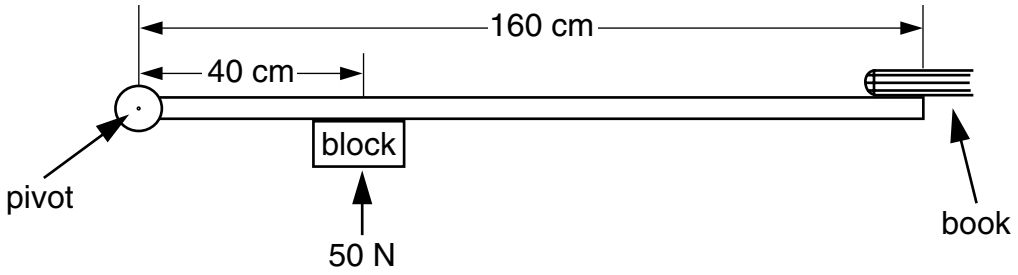
..... (3)

The diagram now shows a book on the right hand end of the plank; the book just keeps the plank balanced.



(c) Show that the weight of the book is 12.5 N. You should ignore the weight of the plank.

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..... (3)

9. You are given three torches, all of which look similar, but all of which you think shine with a slightly different brightness.

You have available a LDR, a sensitive ammeter and a battery.

(a) Draw a diagram of the circuit you would use to measure the brightness of a torch.

(3)

(b) How could you use this apparatus to compare the brightness of each of the three torches? You should explain how you would make your test a fair one.

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..... (4)

(Total marks: 60)