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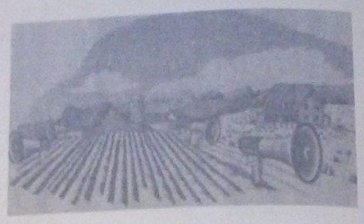
1. ***This question is about the properties of an LDR.***



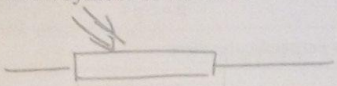
John is a farmer. He is having a problem with birds since they are eating away his crops during the day. He has bought a bird scaring device which he needs to switch on from sunrise till sunset. To do this, the supplier gave John an LDR. John needs your help in installing the apparatus.

a. What does LDR stand for?

Light Dependant Resistor

(1 mark)

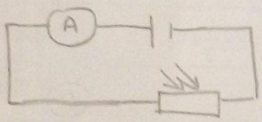
b. In the space below draw the circuit symbol of an LDR.

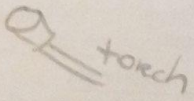


(1 mark)

c. Apart from John's LDR you are given a power supply, an ammeter, a torch with three levels of brightness and connecting wires.

i. Using the correct circuit symbols, in the space below, draw a diagram showing the circuit you would use to show John how a LDR works.





(2 marks)

ii. Describe how, using the above circuit, you can show John how the LDR works. Indicate the variables you are investigating.

- Set up apparatus as shown.
- Switch on torch on low brightness.
- Note current in Ammeter.
- Chage the level of brightness
- Note current in ammeter
- Repeat with the last level of brightness

Brightness of light	Current
Level 1	
Level 2	
Level 3	

(5 marks)

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iii. Mention one precaution you would take.

Keep torch at the same position compared to LDR.

(1 mark)

iv. Following your investigation, what is the relationship between the resistance of an LDR and current in a circuit?

↑ Light, ↑ Current, ↓ Resistance.

∴ Current & Resistance are inversely ∝.

(2 marks)

v. What changes should John do to the circuit in c(i) when he installs the bird scaring device?

(2 marks)

d. When the farmer went to install the bird scaring device he got confused. So, he went to the nearest ironmonger and bought an electronic timer, so that the device switches on and off automatically at a particular time. He plugged the device in the timer and made the following settings:

ON	**7.00 am**
OFF	**7.00 pm**

i. Is this setting suitable for the whole year? Why?

No, since along the year, sunrise & sunset are not always at the same time, we have periods of longer days & shorter nights

(2 mark

ii. How would the LDR set up be more effective?

Since it will switch on & off automatically when the sun rises & sun sets respectively.

(2 mar

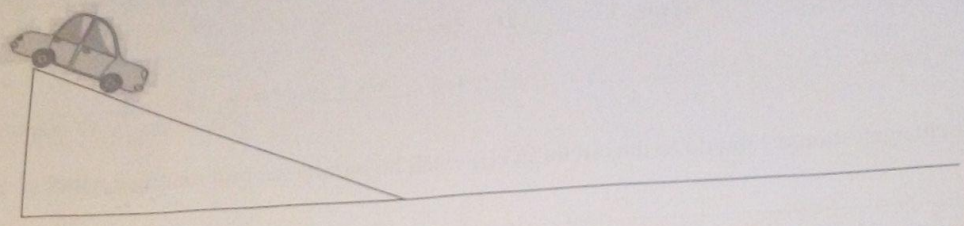
. Give one other situation where the LDR might be useful and explain its function.

Street lights. It will be used in a switching circuit to switch on when the sun sets and off when the sun rises

(2 ma

2. ***This question is about forces and motion.***

a. Julie and Edward investigate the factors that determine the stopping distance of a toy car after it rolls down a ramp. They investigate how the height of the ramp determines the stopping distance of the toy car on horizontal ground.



i. Describe how this investigation can be conducted.

- set up a ramp as shown above with ramp at a specific height
- place car at the top, and let it fall down the ramp without pushing it; - take measurements; - repeat with different heights.

(3 marks)

ii. Name **two** physical quantities which must be kept constant during this investigation.

- mass of the car
- the surface of the ramp

(2 marks)

iii. Name the **two** variables which should be tabulated.

- height of ramp
- stopping distance

(2 mark

iv. Predict the result of this investigation.

↑ height, ↑ stopping distance

(1 ma

v. Name **one** precaution the students should take during the investigation.

- Reading measurements of height & distance with no parallax.

(1 m

b. In an experiment at an accident research laboratory, a car is made to collide with a brick wall.

i. What do you expect to happen to the dummy driver when the car collides with the brick wall? Explain using one of Newton's Laws.

When car collides with the brick wall, the dummy driver is seen to continue to move forward, since he had no stopping external forces acting on it, ∴ it continues to move forward with the same speed.

(3 marks)

ii. The car of mass 800 kg moves at 14 m/s as it hits the brick wall and bounces back initially with the same speed. Calculate the change in momentum of the car.

$m = 800\,kg$. $\quad \Delta mom = mv - mu = m(v-u)$

$u = 14\,m/s$. $\quad \Delta mom = 800(-14-14) = 800(-28)$

$v = -14\,m/s$ $\quad = -22,400\ kg\,m/s$.

(3 marks)

iii. During collision, the car decreases its speed from 14 m/s to 0 m/s in 1.4 s. Calculate the impact force of the brick wall on the car.

$u = 14\,m/s$ $\quad Ft = mv - mu$

$V = 0\,m/s$. $\quad F(1.4) = 800(0-14)$

$t = 1.4s$ $\quad F = \frac{(800)(-14)}{1.4} = \frac{-11200}{1.4} = -8000\,N$

(3 marks)

iv. Explain how the use of a seat belt increases the safety of the dummy.

seat belt is made to stretch a little before it stops the dummy, hence impact time ↑, and force on dummy ↓, ∴ safer

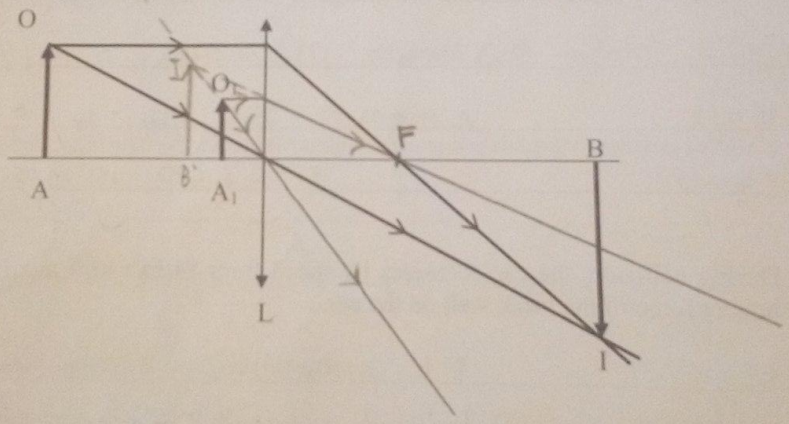
(2 marks)

3. ***This question is about light and lenses.***

a. Complete the paragraph below by filling in the blanks with the most appropriate word.

There are two types of lenses -; convex and concave. Lenses work by the process of refraction. Lenses are made by using a piece of glass or perspex. A convex lens is also known as a converging lens since it brings together the rays whilst concave lenses diverge the rays. (5 marks)

b. Maria places an object in front of a lens and measures the image distance. She then draws a ray diagram. The figure shows two rays from the top of the object OA which pass through the lens L to the top of image IB.



i. Mark on the diagram the focal point of the lens with an F and measure the focal length.

Focal length = 2·1cm

(2 marks)

ii. Describe the image IB.

inverted, magnified + real

(2 marks)

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iii. Calculate the magnification of IB.

mag = $h_i/h_o = \frac{2.7}{1.8} = 1.5$ or $d_i/d_o = \frac{5.15}{3.4} = 1.5$

(1 mark)

iv. Name a practical use of such an image.

projector

(1 mark)

v. Draw two rays from the top of the smaller object O_1A_1 which pass through the lens; hence find the image of O_1A_1 and label it I_1B_1. (2 marks)

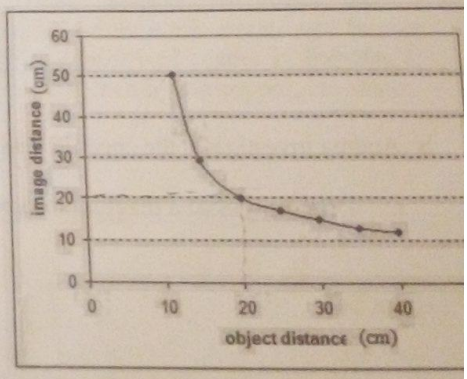
vi. State two differences between the image IB and the image I_1B_1.

IB is real, but I_1B_1 is virtual.

IB is inverted but I_1B_1 is erect

(2 marks)

c. Maria took various measurements each time varying the object distance and measuring the respective image distance. She plotted the graph as shown.



i. From the graph state the relation between the object distance and image distance?

inversely proportional

(1 mark)

ii. From the graph find the focal length of the lens. Show any calculations.

when object is at 2F image is also at 2F ∴2F = 20cm since object distance = image distance, ∴ F = 20/2 = 10cm

(2 marks)

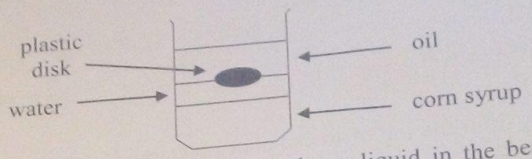
iii. Explain why Maria cannot obtain values for image distance when the object distance is 1 cm and the focal length of a convex lens is 5 cm.

Since object distance is less than focal length 5cm, then object is between F & lens, ∴image distance is a negative value since it forms on the same side of object.

(2 marks)

4. ***This question is about specific heat capacity.***

a. Lisa pours corn syrup into the bottom of an empty beaker. She carefully adds a layer of water and oil as shown in the diagram.



i. Lisa concludes that the corn syrup is the least dense liquid in the beaker. Do you agree? Explain.

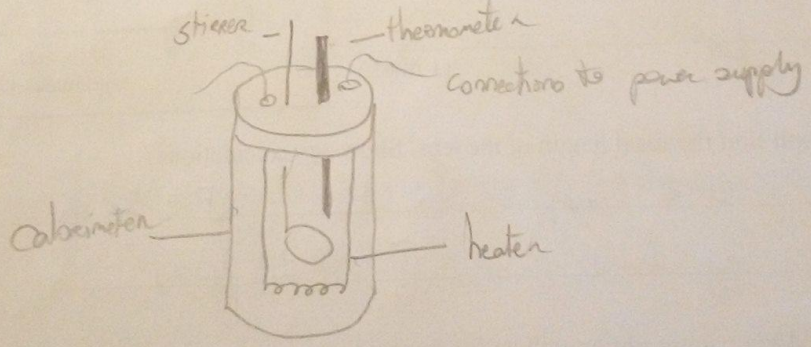
No. Corn syrup is the densest, so, it sinks to the bottom. (2 marks)

ii. A solid plastic disk is observed to float between the oil and the water. Explain.

the disk is denser than oil but less dense than corn syrup (2 mar

b. Andrea investigates the specific heat capacity of an unknown liquid.

i. Draw and label a diagram of the apparatus required to conduct this experiment. (2 mar



ii Describe how the experiment is conducted and the specific heat capacity calculated.

- apparatus set up as shown in diagram
- 1 kg of water is poured in calorimeter

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- initial temp. is read from thermometer, θ_1
- heater switched on for 15 minutes
- final temp. is recorded, θ_2
- power of heater, time, θ_1 + θ_2 are used in $E = mc\Delta\theta$ & $P = E/t$ to find c.

(3 marks)

iii. Name **two** precautions that are required during the experiment.

- Cover the calorimeter by lagging to avoid heat losses.
- Stir the liquid continuously to make sure the heat is distributed evenly

(2 marks)

iv. Would you expect the value for the specific heat capacity obtained to be above or below the value given in data books? Explain.

Greater, since $E = mc(\Delta\theta)$ and more energy is required due to energy losses, $\therefore$ if $E\uparrow$, $c\uparrow$.

(2 marks)

c. A block of copper of mass 1 kg at a temperature of 18 °C is heated for 4 minutes using a Bunsen burner which produces 14 kJ per minute. The specific heat capacity of copper is 385 J/kg°C. Assuming that all the heat produced by the Bunsen burner is absorbed by the copper, calculate:

i. the total amount of heat absorbed by the copper;

14 kJ in 1 min $14,000 \times 4 = 56000$ J.

? in 4 m.

(2 marks)

ii. the final temperature of the copper.

$E = mc(\Delta\theta)$ $\Delta\theta = \frac{56000}{385} = 145°$

$56000 = 1 \times 385 (\Delta\theta)$ $\therefore$ final = 145 + 18 = 163°C

(2 marks)

d. The specific heat capacity of solid aluminium is 904 J/kg°C and that of solid iron is 449 J/kg°C. 1 kg of both solids is heated equally for the same amount of time. What would you expect to observe? Explain.

the temp. of the iron goes up before that of aluminium since 1kg. of iron requires less energy to raise its temp by 1°C

(3 marks)

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5. ***This question is about moments and centre of gravity.***

Monique is placing library books on top of each other. She decides to place them in the form of a staircase.

a. Explain with the **aid of diagrams** why will the books eventually topple over if more books are placed in this way.

Page 8 a

(2 marks)

She then decides to find the mass of one of the books using known weights she found in the physics lab and a pivoted metre ruler.

i. Draw a diagram showing how Monique can use this simple apparatus in order to find the unknown mass of the book. Mark on your diagram any forces. (2 marks)

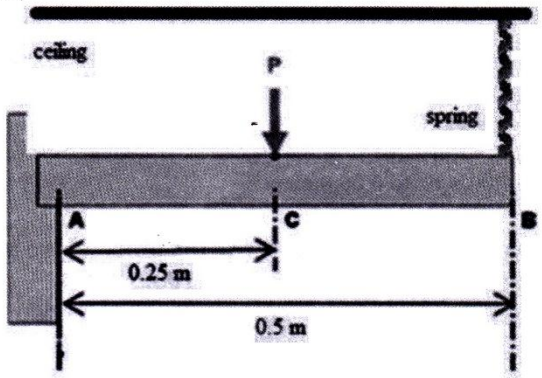
Pg. 8 c i.

i. Describe in detail the method Monique has to perform in order to find the unknown mass of the book, including any formula/working or calculation she has to work out.

Page 8 c ii, iii

(4 marks)

c. Jean Paul built a small uniform trapdoor which is 0.5 m long. It is held by hinges at A and has a mass of 0.4 kg. A spring is attached from the ceiling to point B. He places a pen of mass 0.1 kg at C, 0.25 m away from A.



i. Mark all the forces on the diagram. (3 marks)

ii. Calculate the force exerted by the spring.

Page B dii + iii

(3 marks)

iii. Hence calculate the reaction force at A.

Pg a B d iv.

(1 mark)

iv. Would the reaction force at A and the force exerted by the spring be the same as the answers in (ii) and (iii), had the pen been placed closer to A? Explain.

pen closer to A. less moment ∴ F of spring is less and Reaction Force is greater.

(2 marks)

v. What happens to the spring when a force is exerted on it? Why?

it extends once it is an elastic material that obey Hooke's law.

(2 marks)

vi. What could happen to the spring if a large mass is placed on top of the trapdoor? Explain.

becomes deformed once it exceeds elastic limit

(1 mark)