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Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

PHYSICS

Wednesday 4 June 2008

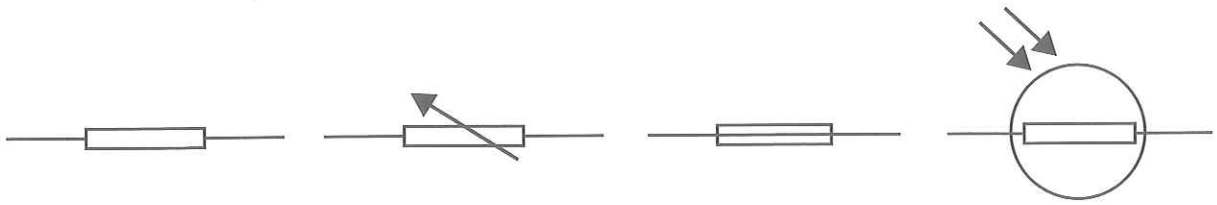
Please read this information before the examination starts.

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

(a) The circuit symbol for a variable resistor is



(b) An arrow which has just been fired horizontally from a bow has been given mainly

kinetic energy **sound energy** **strain energy** **thermal energy**

(c) To measure the mass of some sand, you would use a

balance **measuring cylinder** **metre rule** **newton meter**

(d) 20 cm^3 of a metal which has a density of 5 g/cm^3 will have a mass of

0.25 g **4 g** **25 g** **100 g**

(e) Compared with sound, light travels

a little faster **a little more slowly**

much faster **much more slowly**

(f) A violinist plays a note followed by one of greater frequency. The second note sounds

higher **louder** **lower** **softer**

(g) The Sun is a

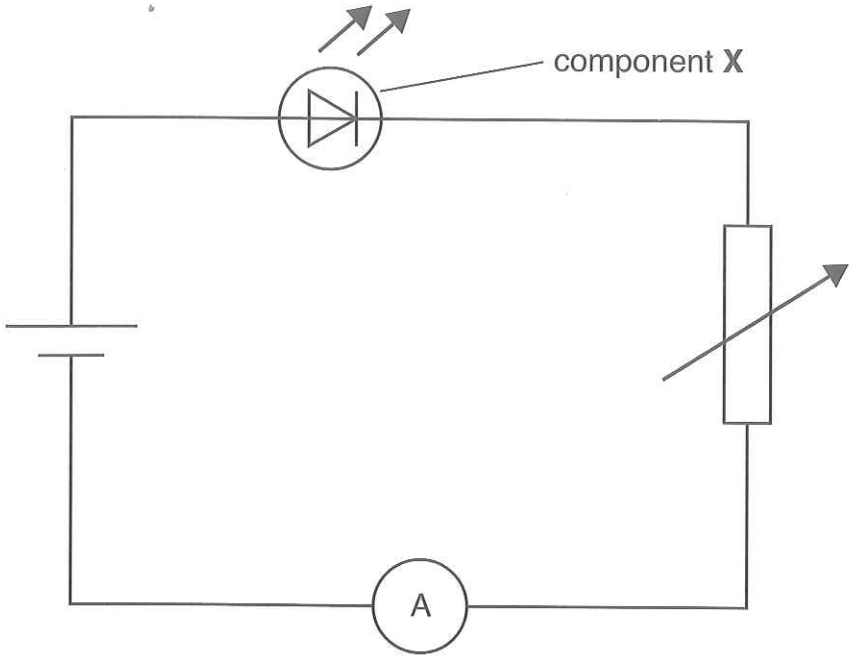
galaxy **moon** **planet** **star**

(h) An example of a renewable energy resource is

coal **gas** **oil** **wind**

(8)

2.



(a) State the name of the component marked **X** in the circuit diagram above.

..... (1)

(b) The ammeter shows a current of 10 milliamps.

(i) What happens to the value of this current if the resistance is increased?

..... (1)

(ii) What will happen to component **X** if the resistance is increased?

..... (1)

(c) A second cell is added in series with the cell in the circuit. State two effects this will have in the circuit.

1: .....

2: ..... (2)

3. By 2010, the target of the UK government is that ten percent of the energy needs of the UK will be provided by renewable resources.

(a) Explain what is meant by a *renewable resource*.

.....

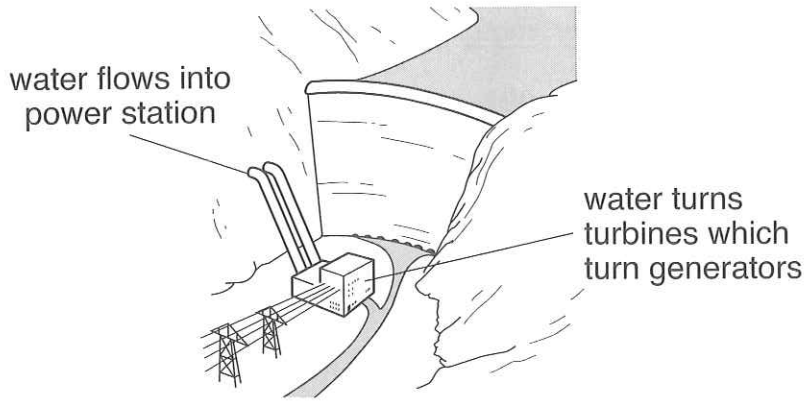
.....

..... (1)

(b) What is the original source of energy for most renewable resources?

..... (1)

One renewable resource is hydro-electric power. A diagram of a hydro-electric power station is shown below:



Gravitational potential energy is stored because of the water behind the dam.

(c) State the form of energy into which this is converted as the water flows down the pipes.

..... (1)

(d) State the useful form into which the energy is finally converted in the power station.

..... (1)

(e) Give two reasons why the UK government intends to increase the amount of energy produced from renewable resources.

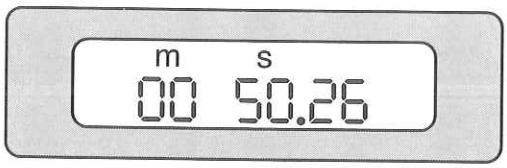
1: .....

.....

2: .....

..... (2)

4. A car travels 600 m. The display on the stopwatch used to measure the time is shown below. It can measure to 0.01 of a second.



(a) Write down the time taken to the nearest second.

..... (1)

(b) Describe how you might plan to measure out the 600 m travelled by the car.

.....

.....

..... (2)

(c) (i) Write down the formula you will use to calculate the speed of the car.

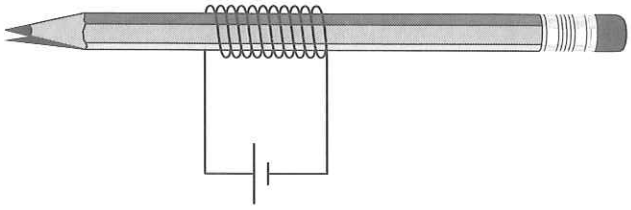
..... (1)

(ii) Calculate the speed of the car. Give the correct unit.

.....

..... (2)

5. A coil of wire is wound round a pencil. The ends of the wire are connected to a cell. The coil of wire forms an electromagnet.



This electromagnet is not very strong.

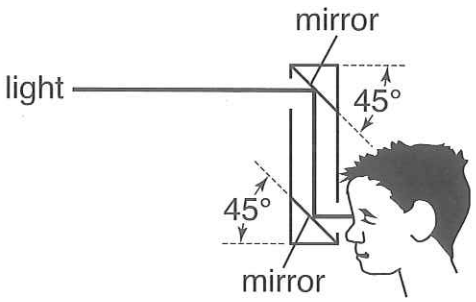
Write down three different things which could be done to make it stronger.

1: .....

2: .....

3: ..... (3)

6. The diagram shows a periscope.



(a) On the diagram, put an arrow on the light ray to show the direction in which the light is travelling. (1)

(b) State the rule for a beam or ray of light reflecting off a flat mirror.

.....

..... (2)

(c) Explain why the two mirrors must be at the angles shown in the diagram.

.....

..... (2)

7. Jonathan did a parachute jump. The picture below shows him falling through the air.



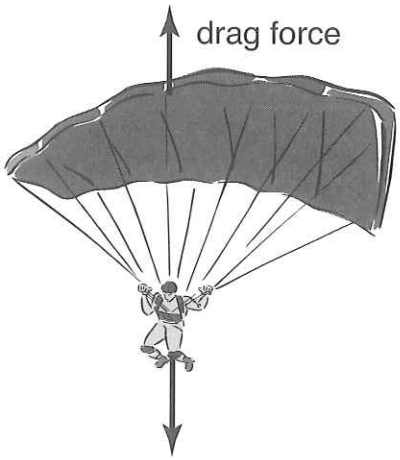
(a) On the diagram above, name the downward force. (1)

Before Jonathan opened his parachute, he was falling very fast but at a steady speed.

(b) Explain why he was falling at a steady speed.

.....

..... (2)



Once he opened his parachute, he slowed down until he was falling much more slowly but also at a steady speed.

(c) (i) Why did he slow down when he first opened the parachute?

.....

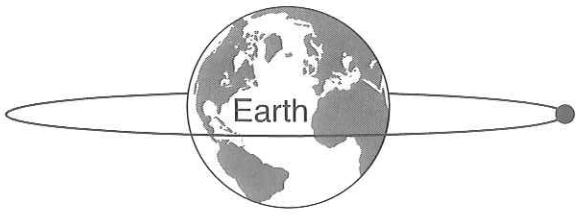
..... (1)

(ii) Explain why he ended up falling at a steady speed again.

.....

..... (1)

8. The picture shows an artificial satellite which has been put into orbit above the equator.



These satellites are used for communications: for example, for broadcasting television programmes. They have to stay above the same place on the equator all the time.

(a) State the force which keeps the satellite in orbit round the Earth.

..... (1)

To stay above the same place on the equator, the satellite must complete one orbit in the same time as it takes the Earth to rotate once.

(b) State the time for one orbit of the satellite.

..... (1)

(c) Explain one reason why it is important for these satellites to stay in the same place above the Earth.

.....

..... (2)

(d) State one other use for an artificial satellite.

..... (1)

The Moon is a natural satellite of the Earth. It is much further from the surface of the Earth than the artificial satellites.

(e) Compared with artificial satellites, does it take longer, the same time or less time for the Moon to orbit the Earth?

..... (1)

We can see the Moon and can sometimes see artificial satellites although they do not give out light.

(f) State and explain how it is that they can be seen.

.....

..... (2)

It would be difficult to live on the Moon.

(g) Suggest two differences between conditions on the Moon and conditions on the Earth.

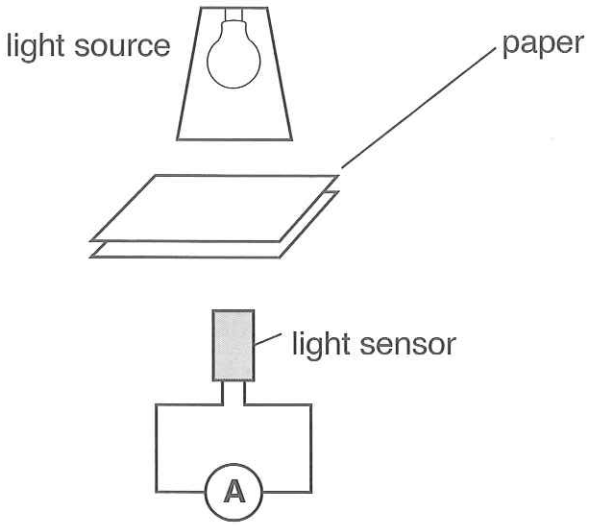
1: .....

.....

2: .....

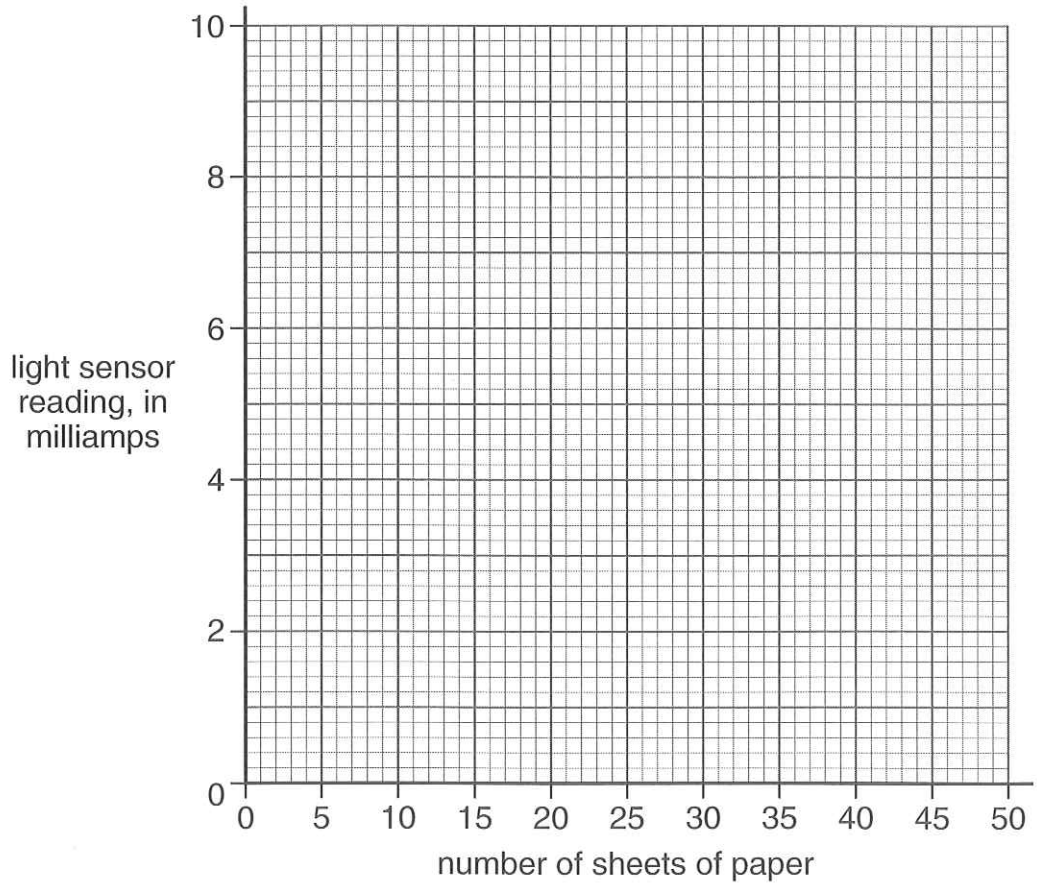
..... (2)

9. Matthew is doing an experiment to measure the amount of light which passes through thin sheets of paper. He sets up the apparatus shown below. The light sensor is connected to an ammeter which measures in milliamps (mA).



number of sheets of paper	0	5	10	15	20	25	30	35	40
light sensor reading, in mA	10.0	8.0	6.0	4.0	3.0	2.2	2.0	2.0	2.0

(a) On the grid below, plot these values. (2)



(b) Draw a suitable graph line. (2)

(c) Explain why the reading on the light sensor goes down as the number of sheets of paper is increased.

.....

..... (2)

The light sensor reading does not fall below about 2 mA when Matthew adds more sheets of paper.

(d) Suggest a reason for this.

..... (1)

Matthew decides to use this method to measure the number of sheets of paper in a pile. He takes a few sheets of paper and puts them between the light and the light sensor. The reading on the meter is 7.2 mA.

(e) Use your graph to decide how many pieces of paper there are in the pile.

..... (1)

This method for measuring the number of sheets of paper has some advantages and some disadvantages.

(f) Explain where it would be a reliable method and where it would start to be an unreliable method for measuring the number of sheets of paper in a pile.

.....

.....

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.....

.....

.....

.....

..... (4)

(Total marks: 60)

The drawing on page 4 is from *Light on Physics* by Fuller and Coates, published by CUP.

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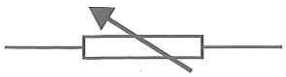
PHYSICS

MARK SCHEME

This is a suggested, not a prescriptive, mark scheme.

Wednesday 4 June 2008

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Q.	Answer	Mark	Additional Guidance
1. (a)		8	
(b)	kinetic energy		
(c)	balance		
(d)	100 g		
(e)	much faster		
(f)	higher		
(g)	star		
(h)	wind		
2. (a)	Light Emitting Diode / LED	1	
(b) (i)	reduces / gets lower / smaller	1	
(ii)	gets dimmer / less bright / goes out	1	
(c)	greater current / more current / increased current / increased reading on ammeter brighter LED / LED comes back on / resistor gets hotter	2	any one from each list of alternatives
3. (a)	source of energy which is constantly replaced	1	not 'does not get used up'
(b)	the Sun	1	
(c)	kinetic energy	1	
(d)	electrical energy	1	
(e)	world supplies of fossil fuels likely to run out / UK oil / coal reserves are running low burning fossil fuels causes greenhouse gases / global warming / pollution coal / oil has a lot of other uses (plastics / drugs etc.)	2	any two sensible and different points
4. (a)	50 (s)	1	do not allow 50.26 s
(b)	use a tape measure / trundle wheel / bicycle computer / car mileometer / school athletics track! mark the start and finish of the 600 m with posts / marks on the ground	2	not metre rule accept any two sensible statements

Q.	Answer	Mark	Additional Guidance
(c) (i)	speed = $\frac{\text{distance}}{\text{time}}$	1	
(ii)	speed = $\frac{600}{50}$ = 12 m/s	2	allow correct calculation from incorrect time using 50.26 s gives 11.94 m/s
5.	increase the number of coils / more coils increase the current / more cells wind the coil round an iron core	3	'thicker wire' could be allowed instead of 'greater current' / 'more cells'
6. (a)	arrow on ray towards eye	1	
(b)	light (ray / beam) reflects at the same angle / same direction (to the normal / to the surface) as the incident / original light (ray / beam)	2	
(c)	each time the beam / ray must be bent 90° therefore beam / ray must strike mirror at 45° since 2 × 45° = 90°	2	two ideas (symmetry) because light reflects at the same angle application of rule from (b)
7. (a)	weight	1	allow 'gravity' but not 'downwards force'
(b)	drag force = weight no unbalanced forces on him	2	
(c) (i)	drag force now greater (than his weight)	1	
(ii)	drag force get smaller as he slows; it becomes equal to his weight again	1	
8. (a)	gravity	1	
(b)	24 h / 1 day	1	
(c)	satellites broadcast to one part of the world customers do not want to have to constantly reposition their dishes	2	any sensible suggestion 1 mark for the reason and 1 mark for elaboration alternative answer overleaf

Q.	Answer	Mark	Additional Guidance
(c) cont	*or* satellites broadcast radio / TV programmes 24 h per day there would be a break in reception if they did not stay in the same place		
(d)	GPS / weather / spy / imaging / deep space telescopes / remote sensing	**1**	any one of these
(e)	longer	**1**	
(f)	light from the Sun is reflected off them (into our eyes)	**2**	
(g)	no atmosphere on the Moon colder on the Moon in the shade / at night less gravity on the Moon	**2**	any two it must be clear whether the difference applies to Earth or Moon
9. (a)	*accurate plotting*	**2**	$\frac{1}{2}$ mark off for each plotting error
(b)	straight line for 0–15 and 30–40 sheets good fit curve for 15–30 sheets	**2**	
(c)	less light from the light source reaches the sensor	**2**	
(d)	light in the lab / maximum resistance for sensor	**1**	any sensible reason
(e)	7	**1**	do not allow fractional sheets of paper
(f)	with up to 15 pieces of paper, the meter reading changes linearly with number of pieces; easy to distinguish the readings for different numbers of sheets with more than 15 pieces of paper, reading changes much less; more difficult to distinguish between numbers of sheets above 30 sheets, no change of reading; therefore useless for purpose	**4**	any two points well made max. 2 marks if not quantitative anywhere
Total		**60**	