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ICSE 2013 : SCIENCE Paper 1 (Physics)

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PHYSICS

SCIENCE Paper – 1

(One hour and a half)

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the Question Paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Section I is compulsory. Attempt any four questions from Section II.

The intended marks for questions or parts of questions are given in brackets [].

SECTION I (40 Marks)

Attempt all questions from this Section.

Question 1

- (a) Give any two effects of a force on a non-rigid body. [2]
- (b) One end of a spring is kept fixed while the other end is stretched by a force as shown in the diagram.



- (i) Copy the diagram and mark on it the direction of the restoring force.
- (ii) Name one instrument which works on the above principle. [2]
- (c) (i) Where is the centre of gravity of a uniform ring situated?
- (ii) 'The position of the centre of gravity of a body remains unchanged even when the body is deformed.' State whether the statement is *true* or *false*. [2]
- (d) A force is applied on a body of mass 20 kg moving with a velocity of 40 ms^{-1} . The body attains a velocity of 50 ms^{-1} in 2 seconds. Calculate the work done by the body. [2]
- (e) A type of single pulley is very often used as a machine even though it does not give any gain in mechanical advantage.
- (i) Name the type of pulley used.
- (ii) For what purpose is such a pulley used? [2]

This Paper consists of 7 printed pages and 1 blank page.

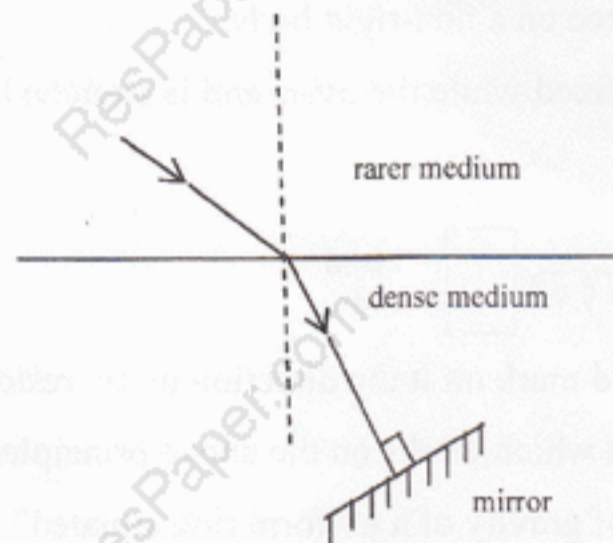
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Turn over

Question 2

- (a) (i) In what way does an 'Ideal machine' differ from a 'Practical machine'?
- (ii) Can a simple machine act as a force multiplier and a speed multiplier at the same time? [2]
- (b) A girl of mass 35 kg climbs up from the first floor of a building at a height 4 m above the ground to the third floor at a height 12 m above the ground. What will be the increase in her gravitational potential energy? ($g = 10 \text{ ms}^{-2}$). [2]
- (c) Which class of lever found in the human body is being used by a boy –
- (i) when he holds a load on the palm of his hand.
- (ii) when he raises the weight of his body on his toes? [2]
- (d) A ray of light is moving from a rarer medium to a denser medium and strikes a plane mirror placed at 90° to the direction of the ray as shown in the diagram.



- (i) Copy the diagram and mark arrows to show the path of the ray of light after it is reflected from the mirror.
- (ii) Name the principle you have used to mark the arrows to show the direction of the ray. [2]
- (e) (i) The refractive index of glass with respect to air is 1.5. What is the value of the refractive index of air with respect to glass?
- (ii) A ray of light is incident as a normal ray on the surface of separation of two different mediums. What is the value of the angle of incidence in this case? [2]

Question 3

(a) A bucket kept under a running tap is getting filled with water. A person sitting at a distance is able to get an idea when the bucket is about to be filled.

(i) What change takes place in the sound to give this idea?

(ii) What causes the change in the sound?

[2]

(b) A sound made on the surface of a lake takes 3 s to reach a boatman.

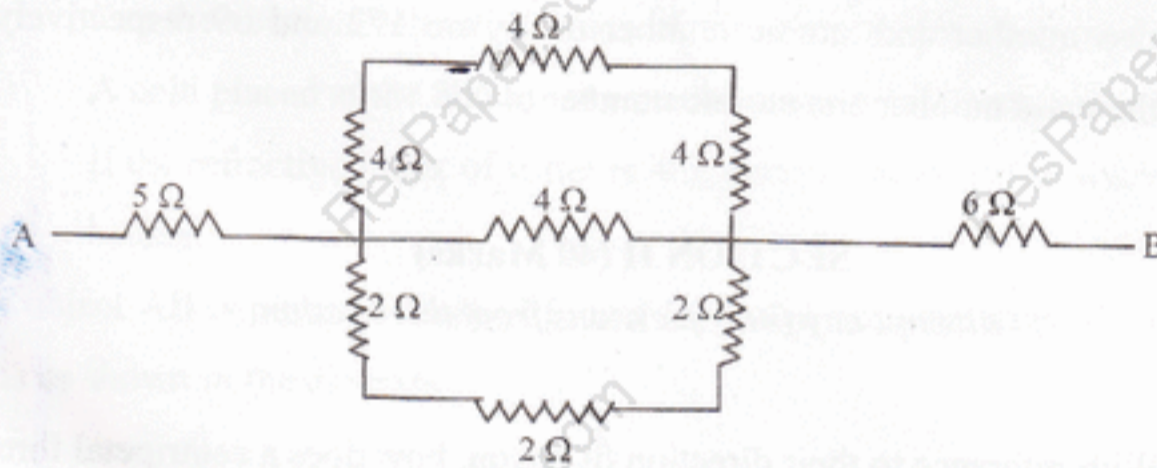
How much time will it take to reach a diver inside the water at the same depth?

Velocity of sound in air = 330 ms^{-1}

Velocity of sound in water = 1450 ms^{-1}

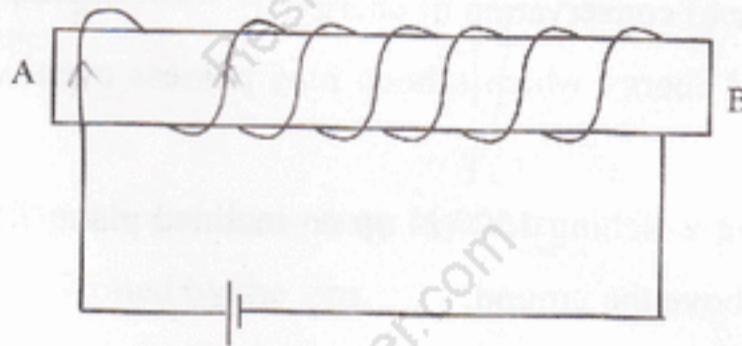
[2]

(c) Calculate the equivalent resistance between the points A and B for the following combination of resistors:



[2]

(d) You have been provided with a solenoid AB.



(i) What is the polarity at end A?

(ii) Give *one* advantage of an electromagnet over a permanent magnet.

[2]

(e) (i) Name the device used to protect the electric circuits from overloading and short circuits.

(ii) On what effect of electricity does the above device work?

[2]

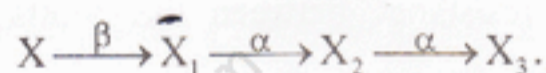
Question 4

- (a) Define the term 'Heat capacity' and state its S.I unit. [2]
- (b) What is meant by Global warming? [2]
- (c) How much heat energy is released when 5 g of water at 20 °C changes to ice at 0 °C?

[Specific heat capacity of water = 4.2 J g⁻¹ °C⁻¹

Specific latent heat of fusion of ice = 336 J g⁻¹] [2]

- (d) Which of the radioactive radiations -
- (i) can cause severe genetical disorders.
- (ii) are deflected by an electric field? [2]
- (e) A radioactive nucleus undergoes a series of decays according to the sequence



If the mass number and atomic number of X₃ are 172 and 69 respectively, what is the mass number and atomic number of X? [2]

SECTION II (40 Marks)

Attempt any four questions from this Section.

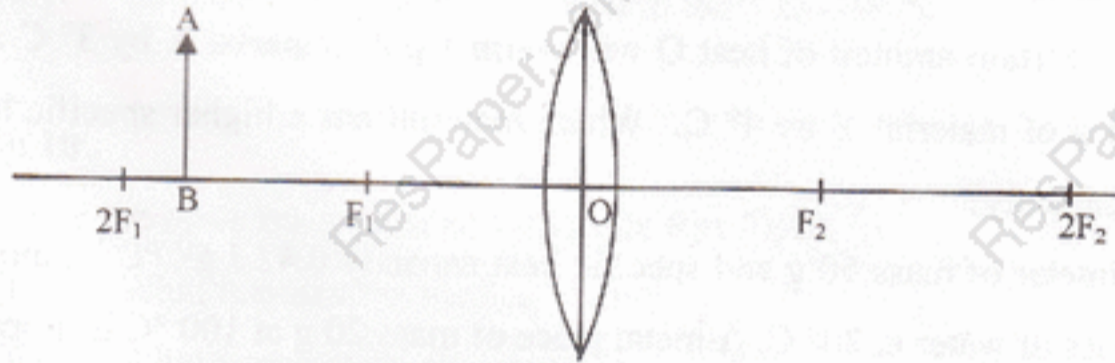
Question 5

- (a) (i) With reference to their direction of action, how does a centripetal force differ from a centrifugal force?
- (ii) State the Principle of conservation of energy.
- (iii) Name the form of energy which a body may possess even when it is not in motion. [3]
- (b) A coolie is pushing a box weighing 1500 N up an inclined plane 7.5 m long on to a platform, 2.5 m above the ground.
- (i) Calculate the mechanical advantage of the inclined plane.
- (ii) Calculate the effort applied by the coolie.
- (iii) In actual practice, the coolie needs to apply more effort than what is calculated. Give one reason why you think the coolie needs to apply more effort. [3]

- (c) A block and tackle system of pulleys has a velocity ratio 4.
- Draw a labelled diagram of the system indicating clearly the points of application and directions of load and effort.
 - What is the value of the mechanical advantage of the given pulley system if it is an ideal pulley system?
- [4]

Question 6

- (a) Name the radiations:
- that are used for photography at night.
 - used for detection of fracture in bones.
 - whose wavelength range is from 100 \AA to 4000 \AA (or 10 nm to 400 nm).
- [3]
- (b) (i) Can the absolute refractive index of a medium be less than one?
- (ii) A coin placed at the bottom of a beaker appears to be raised by 4.0 cm . If the refractive index of water is $\frac{4}{3}$, find the depth of the water in the beaker.
- [3]
- (c) An object AB is placed between $2F_1$ and F_1 on the principal axis of a convex lens as shown in the diagram:



Copy the diagram and using three rays starting from point A, obtain the image of the object formed by the lens.

[4]

Question 7

- (a) (i) What is the principle on which SONAR is based?
- (ii) An observer stands at a certain distance away from a cliff and produces a loud sound. He hears the echo of the sound after 1.8 s . Calculate the distance between the cliff and the observer if the velocity of sound in air is 340 ms^{-1} .
- [3]

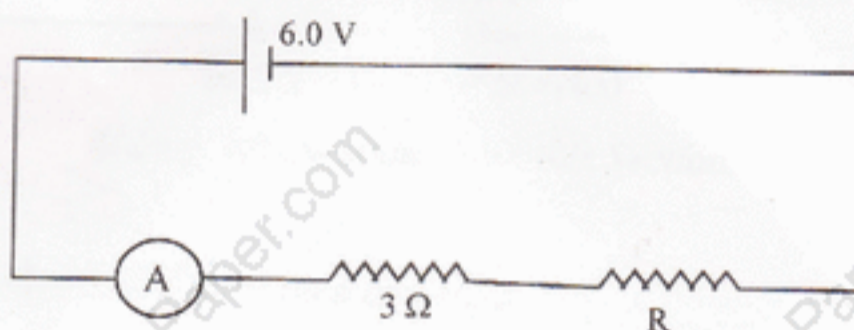
- (b) A vibrating tuning fork is placed over the mouth of a burette filled with water. The tap of the burette is opened and the water level gradually starts falling. It is found that the sound from the tuning fork becomes very loud for a particular length of the water column.
- Name the phenomenon taking place when this happens.
 - Why does the sound become very loud for this length of the water column? [3]
- (c)
 - What is meant by the terms (1) amplitude (2) frequency, of a wave?
 - Explain why stringed musical instruments, like the guitar, are provided with a hollow box. [4]

Question 8

- (a)
 - It is observed that the temperature of the surroundings starts falling when the ice in a frozen lake starts melting. Give a reason for the observation.
 - How is the heat capacity of the body related to its specific heat capacity? [3]
- (b)
 - Why does a bottle of soft drink cool faster when surrounded by ice cubes than by ice cold water, both at 0°C ?
 - A certain amount of heat Q will warm 1 g of material X by 3°C and 1 g of material Y by 4°C . Which material has a higher specific heat capacity? [3]
- (c) A calorimeter of mass 50 g and specific heat capacity $0.42\text{ J g}^{-1}\text{ }^{\circ}\text{C}^{-1}$ contains some mass of water at 20°C . A metal piece of mass 20 g at 100°C is dropped into the calorimeter. After stirring, the final temperature of the mixture is found to be 22°C . Find the mass of water used in the calorimeter. [4]
 [specific heat capacity of the metal piece = $0.3\text{ J g}^{-1}\text{ }^{\circ}\text{C}^{-1}$
 specific heat capacity of water = $4.2\text{ J g}^{-1}\text{ }^{\circ}\text{C}^{-1}$]

Question 9

- (a) (i) State Ohm's law. [3]
- (ii) A metal wire of resistance $6\ \Omega$ is stretched so that its length is increased to twice its original length. Calculate its new resistance. [3]
- (b) (i) An electrical gadget can give an electric shock to its user under certain circumstances. Mention any two of these circumstances. [3]
- (ii) What preventive measure provided in a gadget can protect a person from an electric shock? [3]
- (c) The figure shows a circuit



When the circuit is switched on, the ammeter reads $0.5\ \text{A}$.

- (i) Calculate the value of the unknown resistor R . [4]
- (ii) Calculate the charge passing through the $3\ \Omega$ resistor in $120\ \text{s}$. [4]
- (iii) Calculate the power dissipated in the $3\ \Omega$ resistor. [4]
- Question 10**
- (a) Name the *three* main parts of a Cathode Ray Tube. [3]
- (b) (i) What is meant by Radioactivity? [3]
- (ii) What is meant by nuclear waste? [3]
- (iii) Suggest *one* effective way for the safe disposal of nuclear waste. [3]
- (c) (i) Draw a simple labelled diagram of a d.c. electric motor. [4]
- (ii) What is the function of the split rings in a d.c. motor? [4]
- (iii) State *one* advantage of a.c. over d.c. [4]