**2010 Leaving Cert Physics Paper (Ordinary Level)**

1

You carried out an experiment to investigate the relationship between the acceleration of a body and the force applied to it.

You did this by applying a force to a body and measuring the resulting acceleration.

The table shows the data recorded during the experiment.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Force / N | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 |
| acceleration / m s−2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |

1. Draw a labelled diagram of the apparatus you used
2. How did you measure the applied force?
3. How did you minimise the effect of friction during the experiment?
4. Plot a graph on graph paper of the body’s acceleration against the force applied to it
5. What does your graph tell you about the relationship between the acceleration of the body and the force applied to it?

2

A student carried out an experiment to measure the specific heat capacity of a substance.

The following is an extract from her report.

“I set up the apparatus. I took a series of measurements before I heated the substance. I then took further measurements. I used these measurements to find the specific heat capacity of the substance.”

1. Draw a labelled diagram of the apparatus used in the experiment.
2. Describe how the mass of the substance was determined.
3. What other measurements did the student take during the experiment?
4. Give the formula used to calculate the specific heat capacity of the substance.
5. Give a precaution that the student should have taken to get an accurate result.

3.

A student carried out an experiment to measure the focal length of a concave mirror.

The student placed an object in front of the mirror so that a real image was formed.

The student repeated the experiment by placing the object at different positions and each time recorded the object distance *u* and the image distance *v*.

|  |  |  |  |
| --- | --- | --- | --- |
| *u/*cm | 20 | 30 | 50 |
| *v/*cm | 65 | 32 | 23 |

The table shows the data recorded by the student.

1. Draw a labelled diagram showing how the apparatus was arranged.
2. Mark the distances *u* and *v* on your diagram.
3. How was the position of the real image located?
4. Calculate the value for the focal length *f* of the mirror using the data.
5. Why did the student repeat the experiment?

4

In an experiment to determine the resistivity of the material of a wire, a student measured the length, diameter and resistance of a sample of nichrome wire.

|  |  |  |
| --- | --- | --- |
| *R*/Ω | 20.2 |  |
| *l*/cm | 48.8 |  |
| *d*/mm | 0.21 | 0.20 | 0.18 |

The table shows the data recorded by the student.

1. Describe how the student measured the resistance of the wire.
2. Describe how the length of the wire was measured.
3. What instrument did the student use to measure the diameter of the wire?
4. Why did the student measure the diameter of the wire at different places?
5. Using the data, calculate the cross-sectional area of the wire.
6. Find the resistivity of nichrome.

5

1. State Boyle’s law
2. A concrete mixer delivered 50 m3 of concrete to a building site, what was the mass of the concrete delivered?

(Density of concrete = 2400 kg m−3)

1. State Archimedes’ Principle
2. Which of these scientists is associated with the law of refraction of light? Rutherford Snell Joule Einstein
3. If the temperature of an object is 28 0C, what is its temperature in Kelvin?
4. Give one difference between a light wave and a sound wave
5. Sketch the magnetic field surrounding a bar magnet
6. Give a common use of capacitors.
7. In relation to semiconductors, what is meant by the term doping?
8. What type of nuclear reaction occurs in a nuclear power station?

6

1. Define momentum
2. Define kinetic energy
3. State the principle of conservation of momentum.
4. Explain how this principle applies in launching a spacecraft.
5. An ice skater of mass 50 kg was moving with a speed of 6 m s−1 then she collides with another skater of mass 70 kg who was standing still. The two skaters then moved off together.

Calculate the momentum of each skater before the collision?

1. What is the momentum of the combined skaters after the collision?

300 kg m s−1

1. Calculate the speed of the two skaters after the collision.
2. Calculate the kinetic energy of each skater before the collision.
3. Calculate the kinetic energy of the pair of skaters after the collision.
4. Comment on the total kinetic energy values before and after the collision.

7

The diagram shows a waveform.



1. What is the name given to the distance X and Y?
2. What is meant by the frequency of a wave?
3. Explain the term natural frequency.
4. If the natural frequency of a string is 250 Hz calculate the wavelength of the sound wave produced.
5. State the wave property on which the loudness, the pitch, of a musical note depends.
6. An opera singer, singing a high pitched note, can shatter a glass. Explain why.
7. Describe a laboratory experiment to demonstrate resonance

8

(a)

1. What is heat?
2. Explain how heat transferred in a solid?
3. Describe an experiment to compare the rates of heat transfer through different solids.
4. Explain the term U-value
5. How can the U-value of the walls of a house be reduced?



(b)

The diagram shows a solar heating system.

1. How is the sun’s energy transferred to the solar collector?
2. Why is the solar collector normally painted black?
3. How is the heat transferred from the solar panel to the hot water tank?
4. The heating coil for the hot water tank are placed at the bottom, explain why.
5. Give an advantage and a disadvantage of a solar heating system.

9

(a)

1. State Coulomb’s law of force between electric charges.
2. How would you detect the presence of an electric field?
3. What is the unit of electric charge?
4. How does the lightning conductor prevent damage to the building?
5. Suggest a suitable material for a lightning conductor.



(b)

1. State Ohm’s law
2. The diagram shows a number of resistors connected to a 12 V battery and a bulb whose resistance is 4 Ω.

Calculate the combined resistance of the 15 Ω and 30 Ω resistors in parallel.

1. Calculate the total resistance of the circuit
2. Calculate the current flowing in the circuit

10

X-rays are produced when high speed electrons collide with a target in an X-ray tube as shown in the diagram.

1. What process occurs at the filament A?
2. Name a substance commonly used as the target B
3. Give three properties of X-rays
4. Give two uses of X-rays
5. State the function of the part marked C
6. The photoelectric effect can be regarded as the inverse of X-ray production.
7. Describe an experiment to demonstrate the photoelectric effect
8. Give two applications of the photoelectric effect

11

Read this passage and answer the questions below.

In 1819 the Danish physicist Hans Christian Oersted discovered that an electric current flowing through a wire deflected a compass needle.

A year later the Frenchman François Arago found that a wire carrying an electric current acted as a magnet and could attract iron filings. Soon his compatriot André-Marie Ampère demonstrated that two parallel wires were attracted towards one another if each had a current flowing through it in the same direction. However, the wires repelled each other if the currents flowed in the opposite directions.

Intrigued by the fact that a flow of electricity could create magnetism, the great British experimentalist Michael Faraday decided to see if he could generate electricity using magnetism. He pushed a bar magnet in and out of a coil of wire and found an electric current being generated. The current stopped whenever the magnet was motionless within the coil.

(Adapted from ‘*Quantum' by Manjit Kumar, Icon Books 2008*)

1. Who discovered that an electric current can deflect a compass needle?
2. What did Arago discover?
3. What happens when currents flows in the same direction in two parallel wires?
4. How could two parallel wires be made to repel each other?
5. Draw a sketch of the apparatus Michael Faraday used to generate electricity.
6. What name is given to the generation of electricity discovered by Michael Faraday?
7. What energy conversions that take place in Faraday’s experiment
8. How does Faraday’s experiment show that a changing magnetic field is required to generate electricity?

12 (a)

A cyclist on a bike has a combined mass of 120 kg.

The cyclist starts from rest and by pedalling applies a net force of 60 N to move the bike along a horizontal road.

1. Calculate the acceleration of the cyclist
2. Calculate the maximum velocity of the cyclist after 15 seconds.
3. Calculate the distance travelled by the cyclist during the first 15 seconds.
4. The cyclist stops peddling after 15 seconds and continues to freewheel for a further 80 m before coming to a stop. Why does the bike stop?
5. Calculate the time taken for the cyclist to travel the final 80 m?

12 (b)

1. What is meant by dispersion of light?
2. Describe an experiment to demonstrate the dispersion of light.
3. Give an example of the dispersion of light occurring in nature.
4. Only red, green and blue lights are needed to create most lighting effects.

Explain why

12 (c)

The diagram shows a plug which contains a fuse, an MCB and an RCD, all of which are used in domestic circuits.



1. Explain how a fuse works
2. How does the fuse improve safety?
3. What is an MCB?
4. What is the function of an RCD?
5. Why should an appliance be earthed?
6. Give one other precaution that should be taken to improve safety when using electricity in the home.

12 (d)

1. What is radioactivity?

Disintegration/decay of nuclei/atoms with emission of radiation/energy /α / β / γ



1. The diagram shows a shielded radioactive source emitting nuclear radiation.

How do you know that the source is emitting three types of radiation?

1. Name the radiation blocked by each material
2. Give one danger associated with nuclear radiation
3. State two precautions that should be taken when handling radioactive substances.
4. Give two uses for radioactive substances