**2012 Ordinary Level**

**2012 Leaving Cert Physics Paper (Ordinary Level)**

**2012 no.1**

A student carried out an experiment to measure the acceleration of a moving trolley.

The student measured the initial velocity of the trolley and the final velocity of the trolley, along with another measurement. The student used these measurements to find the acceleration of the trolley.

1. **Draw a diagram to show how the student got the trolley to accelerate.**

Diagram to show: trolley and runway // air track and glider

 Tilt runway, apply force, ticker timer, motion sensor

1. **Describe how the student measured the final velocity of the trolley**.

Using a motion sensor // distance between (eleven) dots divided by time

1. **What other measurement did the student take?**

Distance, time

1. **How did the student use the measurements to calculate the acceleration of the trolley?**

Acceleration = change in velocity divided by time

1. **Give a precaution the student took to ensure an accurate result.**

Oil the wheels, clean the runway, ignore the initial tickertape dots, reduce the friction, etc.

**2012 no.2**

You carried out an experiment to establish the calibration curve of a thermometer.

1. **Describe, with the aid of a diagram, the procedure you used in the experiment.**

diagram to show: container and water thermometer (in water) // temperature sensor heat source; hot plate / Bunsen record at least two thermometric property measurements detail e.g. stirrer, ruler, 2nd thermometer, means of recording thermometric property, datalogger, etc.

1. **Name the thermometric property of the thermometer you calibrated and describe how the value of this property was measured.**
length of column of mercury: measure length with ruler

Resistance (of thermistor): measure resistance with ohmmeter etc.

1. The following table shows the data obtained in an experiment to establish the calibration curve of a thermometer.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Temperature/ 0C | 0 | 20 | 40 | 60 | 80 | 100 |
| Value of thermometric property | 5 | 14 | 29 | 48 | 80 | 130 |

**Using the data in the table, draw a graph on graph paper to establish the calibration curve.**

Put temperature on the horizontal axis.



1. **Use your calibration curve to determine the temperature when the value of the thermometric property is 60.**

70 +- 3 0C

**2012 no.3**

A student carried out an experiment to verify Snell’s law of refraction.

The student measuredthe angle of incidence *i* and the corresponding angle of refraction *r* for a ray of light passingthrough a glass block. The student repeated this procedure for different values of the angle *i*.

The data recorded by the student are shown in the table.

1. **Draw a labelled diagram of the apparatus used in the experiment.**

Labelled diagram to show: glass block, laser / ray box / pins / protractor / ruler / sheet of paper

1. **Describe how the student found the path of the ray of light passing through the glass block.**

Refracted ray described or drawn

refers to the incident ray / emerging ray

1. Indicate on the diagram the angles *i* and *r*.



1. **Copy this table into your answerbook and complete it.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *i* | *r* | sin *i* | sin *r* | $$\frac{\sin(i)}{\sin(r)}$$ |
| 250 | 160 | 0.423 | 0.276 | 1.533 |
| 350 | 220 | 0.574 | 0.375 | 1.531 |
| 500 | 300 | 0.766 | 0.500 | 1.532 |
| 600 | 340 | 0.866 | 0.559 | 1.549 |

1. **How does the data in the completed table verify Snell’s law of refraction?**

sin *i* divided by sin *r* is constant

**2012 no.4**

In an experiment to investigate the variation of current *I* with potential difference *V* for a copper sulfate solution, the following apparatus was used.

1. **Name the instrument X.**

X is an ammeter.

1. **Name the apparatus Y and give its function in the experiment.**

Y is a potentiometer; it is used to vary the voltage.

1. **How was the potential difference measured in the experiment?**

Using a voltmeter

1. The following table shows the values recorded for the current *I* and the corresponding potential difference *V* during the experiment.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *V*/V | 0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 |
| *I*/A | 0 | 0.4 | 0.8 | 1.2 | 1.6 | 2.0 | 2.4 |

**Using the data in the table, draw a graph on graph paper to show the variation of current with potential difference.**

See graph

1. **Calculate the slope of your graph.**

$slope= \frac{y\_{2}- y\_{1}}{x\_{2}- x\_{1}}= \frac{5- 0}{2- 0}$ = 2.5

1. **Use this value to determine the resistance of the copper sulfate solution.**

R = 2.5 Ω

**2012 no.5**

1. **A tow-truck pulls a car with a net horizontal force of 500 N.**

**Calculate the work done in towing the car a distance of 2 km to a garage.**

*W = Fs* = (500)(2000) =106J

1. **Give one factor on which the potential energy of a body depends.**

Mass, acceleration due to gravity, height

1. **Which one of the following instruments is used to measure atmospheric pressure?**

hydrometer barometer thermometer joulemeter

Answer: barometer

1. **The Tacoma Narrows Bridge collapsed, soon after construction, due to resonance. What is resonance?**

The tendency of a body to oscillate at a greater amplitude at some (forced) frequencies

1. **A building has a low U-value. What is the advantage of this?**

Low energy loss

1. **Why is a lightning conductor made of copper?**

Good conductor and doesn’t corrode

1. **Why does a magnet that is free to rotate point north?**

Because of the earth’s magnetic field.

1. **What is the principle of operation of a transformer?**

A change in magnetic flux induces an emf.

1. **The photo shows an LDR. Draw the electrical circuit symbol for an LDR.**

See diagram

1. **What is the main source of energy in the sun?**

Nuclear fusion (or hydrogen)

**2012 no.6**

1. **What is meant by the term ‘acceleration due to gravity’?**

Acceleration caused by the (gravitational pull of the) earth

A spacecraft of mass 800 kg is on the surface of the moon, where the acceleration due to gravity is 1.6 m s−2.

1. **Compare the weight of the spacecraft on the surface of the moon with its weight on earth, where the acceleration due to gravity is 9.8 m s–2.**

Weight on moon = *mg*m= (800)(1.6) = 1280 N

Weight on earth = *mg*e = (800)(9.8) = 7840 N

So the spacecraft is (7840/1280) = 6.1 times heavier on the earth than on the moon.

The module of the spacecraft has a mass of 600 kg, when it is launched vertically from the surface of the moon with its engine exerting an upward force of 2000 N.



1. **Draw a diagram showing the forces acting on the module at lift-off.**

Weight acting down, thrust acting up.

1. **What is the resultant force on the module?**

*Fnet = (*Fbig – Fsmall*) = (F* - *mg*m) = [2000 - (600)(1.6)] = 1040 N

1. **Calculate the acceleration of the module during lift-off.**

*Fnet* =*ma*  ⇒ 1040 = (600)(*a*) ⇒ *a* = 1.73 m s-2

1. **the velocity of the module, 20 seconds after lift-off.**

(*v = u + at )* i.e. *v* = 0 + (1.73)(20) = 34.6 m s-1

1. **Would the engine of the module be able to lift it off the earth’s surface?**

**Justify your answer in terms of the forces acting on the module.**

No. The force of gravity on the earth is 5880 N (600 × 9.8) and the upward thrust of the spacecraft is only 2000 N.

1. **Why is the acceleration due to gravity on the moon less than the acceleration due to gravity on earth?**

Because the mass of the moon is less than the mass of the earth

1. **Suggest a reason why the module of the spacecraft when launched from the moon does not need a streamlined shape like those that are launched from earth.**

There is no atmosphere on the moon so no air resistance / drag / friction

**2012 no.7**

1. **Explain the underlined terms.**

Diffraction is the spreading out of waves around a barrier / the edges of an opening

Interference occurs when two waves meet and add

1. **Describe an experiment to demonstrate the wave nature of light**

*Apparatus*: (light) source, (diffraction) grating / slits, screen

*Procedure*: shine the (narrow beam of) light through the grating

*Observation/conclusion*; pattern on screen

1. **Explain the term polarisation**

Polarisation is the restriction of (vibrating electromagnetic) waves to a single plane

1. **Describe an experiment to demonstrate the polarisation of light**

*Apparatus*: (two pieces of a) polaroid sheet

*Procedure*: look at the light through the two pieces of Polaroid. Cross/rotate one of the polaroid pieces.

*Observation/conclusion;* the crossed pieces stops the light

1. **What type of wave motion does light have as indicated by the experiment in part**

Transverse

1. **Why are Polaroid sunglasses more effective than non-Polaroid sunglasses at reducing glare?**

Polaroid sunglasses remove most of the polarised reflected light (which causes the glare)

**2012 no.8**

1. **What is the colour of the wire that should be connected to the fuse in a plug?**

Brown

1. **Why is there a fuse in a plug?**

Protection // to prevent current overload // prevent fire, etc.

1. **Explain how a fuse works.**

When the current exceeds a certain value the wire breaks / fuse burns out / circuit breaks

1. **A vacuum cleaner has a power rating of 900 W.**

**What is the most suitable fuse to use in the plug of the vacuum cleaner?**

I = P/V = 900/230 = 3.9

A 5 amp fuse should be used.

1. **Why is a fuse of a lower rating unsuitable?**

It might melt/break /blow / current will be too

1. **Name a device found in modern domestic circuits that has the same function as a fuse.**

Miniature) circuit breakers / MCBs // trip switches // residual current devices / RCDs // trip switch / RCB

1. **If the vacuum cleaner is used for 90 minutes, calculate the number of units of electricity used.**

*P*× *t* = (0.9)( 1.5) = 1.35

1. **Calculate the cost of the energy used if the price of each unit of electricity is 22 cent.**

(1.35)(0.22) =29.7 cent / 30 cent

**2012 no.9**

1. **What is the SI unit of temperature?**

The Kelvin (K)

1. **The Celsius scale is the practical temperature scale.**

**How is the degree Celsius (°C) related to the SI unit of temperature?**

*Temp in Celsius* = *Temp in Kelvin* - 273(.15)

1. **What is heat?**

Heat is a form of energy

1. **Name the three methods of heat transfer.**

Conduction, convection, radiation

1. **What is meant by the change in state of a substance?**

Any change between solid, liquid or gas

1. **Define specific latent heat.**

It’s the amount of energy required to change 1 kg of the substance from one state to another (without a change in temperature).

20 g of ice cubes at 0 °C are added to a glass of warm water. All the ice melts quickly and cools the water to 5 °C.

Assuming no heat transfer to the surroundings or to the glass, calculate:

1. **The energy required to melt the ice**

*E* = *ml* = (20 ×10-3)(3.34 ×105) = 6.68 ×103 J

1. **The energy required to warm the melted ice to 5 °C.**

*E* = mcΔθ = (20×10-3)(4.18 ×103)(5) = 418 J

1. **Why is it important to stir the mixture?**

To ensure temperature equilibrium // to ensure the ice melts quickly

**2012 no.10**

A cathode ray tube and an X-ray tube are practical applications of thermionic emission. In these tubes thermionic emission releases electrons, which are then accelerated into a beam.

An electron is a subatomic particle.

1. **Name another subatomic particle and give two of its properties.**

Proton: *location* inside nucleus *mass* 1(amu) *charge* + 1

Neutron: *location* inside nucleus *mass* 1(amu) *charge* 0

1. **The diagram shows a simple cathode ray tube. Name the parts labelled A, B, C.**

A: cathode. B: anode. C:screen

1. **Give the function of any two of these labelled parts.**

Cathode emits (electrons)

Anode attracts/focuses /accelerates (electrons)

Screen (lights up to) show presence (of electrons)

1. **How can the beam of electrons be deflected?**

Electric field/electrode/magnetic field/magnet/X-Y plates

1. **What happens at C when the electrons hit it?**

Lights up / fluorescence

1. **Why is a vacuum needed in a cathode ray tube?**

Electrons not blocked / easier to pass through / electrons not absorbed

1. **In an X-ray tube, a beam of electrons is used to produce X-rays.**

**Draw a sketch of an X-ray tube.**



1. **Give one safety precaution taken by a radiographer when using an X-ray machine.**

Use a lead shield, protective clothing, lead glass, monitor dosage, reduce dosage, etc.

**2012 no.11**

1. **What is meant by nuclear fission?**

Splitting nuclei // splitting (large) atoms

1. **What is radioactivity?**

Decay/splitting of a nucleus with the emission of particles/radiation 7 partial answer e.g. alpha/ beta /gamma / activity

1. **What is a nuclear chain reaction?**

A chain reaction is when the neutrons released during fission go on to split more atoms / or produce more neutrons

1. **What is the function of the control rods?**

Adjust the power output // absorb neutrons, etc.

1. **What type of material are control rods made of?**

Boron / steel / silver / indium / cadmium, etc. // neutron absorber

1. **Why did the reactor still generate heat even though the chain reaction had stopped?**

Because of the radioactive decay of the isotopes created during nuclear fission

1. **Why is it important to remove the heat generated?**

To avoid over heating/ explosions / release of radiation

1. **Give one advantage of nuclear energy.**

Use less fuel for energy produced // does not pollute the air // fuel can be produced (in a breeder reactor) //no greenhouse gases, etc. 7 partial answer e.g. cheaper, plentiful

**2012 Question 12 (a) [Ordinary Level]**

1. **State the principle of conservation of momentum.**

The Principle of Conservation of Momentum states that in any collision between two objects, the total momentum before impact equals total momentum after impact, provided no external forces act on the system.

1. A cannon of mass 1500 kg containing a cannonball of mass 80 kg was at rest on a horizontal surface as shown.
The cannonball was fired from the cannon with an initial horizontal velocity of 60 m s–1 and the cannon recoiled.
**Calculate the recoil velocity of the cannon**

0 = *m*1 *v*1 + *m*2 *v*2

0 = (1500)( *v*1) + (80)(60)

*v*1 = (-) 3.2 m s-1

1. **Calculate the kinetic energy of the cannon as it recoils.**

(½(1500)(3.2)2= 7680 J

1. **Why did the cannon recoil?**

For momentum to be conserved (because initially there was no momentum and the cannonball went forward).

1. **Why will the cannon come to a stop in a shorter distance that the cannonball?**

Because the cannon has a bigger mass / the resistance of the ground (friction) is bigger than that of air / the cannon had a smaller recoil velocity

**2012 no.12 (b)**

1. **State the laws of reflection of light.**

The incident ray the normal and the reflected ray are all in the one plane.

The angle of incidence is equal to the angle of reflection.

1. **How would you estimate the focal length of a concave mirror?**

Reflect image of distant object onto screen and adjust screen until the image is sharp; distance from screen to mirror is approximate focal length.

1. **The diagram shows an object O in front of a concave mirror, whose focus is at F.**

Copy and complete the diagram to show the formation of the image of the object O.



1. **Give one use for a concave mirror.**

Torch / headlights /searchlight, dentist mirror, cosmetic / shaving mirror, solar furnace

**2012 no.12 (c)**

**The pitch of the sound emitted by the siren of a moving fire engine appears to change as it passes a stationary observer.**

1. **Name this phenomenon.**

Doppler effect

1. **Explain, with the aid of a diagram, how this phenomenon occurs**.

Diagram must show moving wave source and wave fronts.

As the moving wave source approaches the waves get closer together therefore frequency increases.

Conversely as the wave source moves away the waves are further apart therefore frequency decreases.

1. **Will the crew in the fire engine notice this phenomenon?**

**Give a reason for your answer.**

No as there is no relative motion between the sound source and the crew

1. **Give an application of this phenomenon.**

Measuring speed / speed gun, (measuring) red shift, ultrasonic scanners, imaging used to study blood flow, used to study heart beat, weather forecasting, etc. 6 partial answer e.g. general application such as medicine, radar, sonar

**2012 no.12 (d)**

A capacitor is connected to a switch, a battery and a bulb as shown in the diagram.

When the switch is changed from position A to position B, the bulb lights briefly.



1. **What happens to the capacitor when the switch is in position A?**

it charges / short-lived current flows / stores

1. **Why does the bulb light when the switch is in position B?**

Capacitor discharges / current flows // (switch) closes the circuit

1. **Why does the bulb light only briefly?**

capacitor discharges quickly / p.d. fades / current transient / capacitor only holds small charge / capacitor only stores a small amount of energy

1. **The capacitor has a capacitance of 200 μF. Calculate its charge when connected to a 6 V battery.**

Q = CV. Q = (200×10-6)(6) = 1.2 ×10-3 C

1. **Give a use for a capacitor.**

Give a use for a capacitor. 4 or 2 store charge / (radio) tuning / filtering / smoothing / timing / coupling / store energy / flash camera / phone charger, etc. one correct 4 partial answer e.g. storing electric current (