**2018 Leaving Cert Physics Solution (Ordinary Level)**

**2018 no.1**

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

Labelled diagram to show:

Enclosed volume of gas / air

Method of measuring volume e.g. volume scale

Method of measuring pressure e.g. pressure gauge

Method of varying pressure / volume

1. **How were the pressure and volume measured?**

Measure the pressure from the pressure gauge

Measure the volume of trapped air from the scale on the tube

1. **Copy and complete the table.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *V* (cm3) | 2 | 3 | 4 | 5 | 6 | 9 |
| *p* (kPa) | 535 | 350 | 270 | 215 | 180 | 120 |
| 1*/V* (cm-3) | 0.5 | 0.33 | 0.25 | 0.2 | 0.17 | 0.11 |

1. **Explain how the data can be used to verify Boyle’s law.**
Graph of p versus 1/V

Straight line through origin shows that pressure is proportional to 1/volume

1. **State two precautions which the student might have taken to improve the accuracy of this experiment.**
After changing pressure wait a short time

Read the volume of the oil from the bottom of the meniscus

Read the volume scale at eye level/no parallax

**2018 no.2**

1. **Draw a labelled diagram of the apparatus used in this experiment.**
labelled diagram to show:

Beaker of water

Standard thermometer

Uncalibrated thermometer

Heat source

Means of recording thermometric property

Detail to improve the accuracy e.g. stirrer

1. **What measurements were taken during this experiment?**
Thermometric property

Temperature

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

**Put temperature on the horizontal (X) axis.**



1. **Use your graph to determine the temperature when the value of the thermometric property is 75.**
See graph.
480 C

**2018 no.3**

1. **Draw a labelled diagram of the apparatus used in this experiment.**
labelled diagram to show:

string

means of tightening

means of changing frequency e.g. tuning forks / frequency generator

means of varying length e.g. bridge

means of measuring length

means of detecting resonance /paper rider /magnet

detail e.g. sonometer

1. **Indicate on your diagram the length of the string that was measured.**
distance between bridges
2. **Describe how the string was set vibrating.**
placed a vibrating tuning fork on the bridge // turned on frequency generator
3. **How was the frequency of the string determined?**
Read the value from the tuning fork/ frequency generator
4. **Sketch a graph to show the relationship between *l* and *f* that you would expect to obtain.**



**2018 no.**4.

1. **Draw a labelled diagram of the apparatus used in this experiment.**
labelled diagram to show:

length of wire

means of measuring resistance

means of measuring length/diameter/cross‐sectional area

1. **What measurements were taken during this experiment?**
length

resistance

diameter

1. **How were these measurements used to calculate the resistivity?**
Using the formula 
2. **State two precautions which the student might have taken to improve the accuracy of this experiment.**

Remove kinks from wire

Repeat the diameter measurement / take many readings (and get an average)

Use a long length

Ensure the resistance of the leads connecting to the ohmmeter is low

Check for zero error in micrometer, etc.

1. **no.5**
2. **State Newton’s first law of motion.**
A body will remain at rest or moving at a constant velocity unless an external force acts on it.
3. **Calculate the refractive index of the glass block shown in the diagram.**
$ŋ=\frac{\sin(i)}{\sin(r)}= \frac{\sin(40)}{\sin(25)}$ = 1.52
4. **Choose from the list below the instrument used to measure (i) energy and (ii) resistance.**

Energy: joulemeter

Resistance: ohmmeter

1. **State one use for a semiconductor diode.**
rectifier, LED, switches, p.s.u.,
2. **State one use for the instrument shown.**
measure angles/ measure wavelength of light /

demonstrate interference / demonstrate diffraction /

demonstrate spectra / demonstrate monochromatic light

1. **Define capacitance.**

Capacitance is the ratio of charge to potential

1. **State two characteristics of a musical note.**
loudness, amplitude, pitch, frequency, overtone, timbre/quality
2. **Sketch the magnetic field around a bar magnet.**
See diagram
3. **Name two sources of ionising radiation.**
sun, cosmic, named radioactive element, nuclear weapons,

nuclear power plants, etc.

1. **State one application of the photoelectric effect.**

Solar panels, burglar alarms, automatic doors, control of burners in central heating, soundtrack in films, etc.

**2018 no.6**

1. **Define momentum.**
Mass multiplied by velocity / p = mv
2. **Define kinetic energy.**
Energy due to motion OR ½mv2
3. **Use the principle of conservation of momentum to explain why the cannon recoils.**
Cannon recoils to ensure the momentum after is zero //to conserve momentum

/momentum before collision = momentum after collision

Bumper car A of mass 500 kg is moving with a speed of 6 m s−1 when it collides with stationary bumper car B of mass 300 kg. After the collision the cars move together.

1. **Calculate the momentum of each car before the collision.**
Momentum of A= mAvA= (500)(6) = 3000 kg m s‐1

Momentum of B= mBvB= (300)(0) = 0 kg m s‐1

1. **What is the momentum of the combined cars after the collision?**
total momentum before = total momentum after

Total momentum before = 3000 kg m s‐1

So total momentum after = 3000 kg m s‐1

1. **Calculate the speed of the two cars after the collision.**

3000 + 0 = (mA + mB)V3

= (500+300) V3

V3 = 3.75 m s‐1

1. **Calculate the kinetic energy of each car before the collision.**
½mv2 = ½(500)(6)2 = 9000 J

½mv2 = ½(300)(0)2 = 0 J

1. **Calculate the kinetic energy of the cars after the collision.**

½mv2 = ½(500+300)(3.75)2 = 5625 J

1. **What conclusion can be drawn from the change in kinetic energy that happens during the collision?**
kinetic energy is not conserved / is lost

**2018 no.7**

1. **What is heat?**
Heat is a form of energy
2. **What is meant by the temperature of an object?**
Temperature is a measurement of hotness
3. What is the unit of temperature on the SI scale?
The kelvin
4. **Express 20 °C in the units you have named in part (iii).**
273+20 = 293 K
5. **Name the method by which heat is transferred in metals.**
conduction // vibrating atoms (transfer energy)
6. **Name the two other methods of heat transfer.**
convection, radiation
7. **How can this experiment be used to find out which metal is the best at allowing heat transfer?**the pin which falls first indicates the best conductor
8. **State two ways of making sure that this investigation is fair.**

Ensure there is an equal amount of heat for each metal

Ensure that the metal strips are the same length / diameter

Ensure to have the same amount of wax, etc.

1. Metals are good conductors. Name a good insulator.
Paper, plastic, wood, etc.

**2018 no.8**

* 1. **Explain the terms *diffraction***
	Diffraction is the bending/spreading out of waves around a barrier / the edges of an opening
	2. **Explain the term *interference***
	Interference occurs when two waves meet and add
	3. **Describe an experiment to demonstrate the wave nature of light.**
	apparatus: (diffraction) grating / Young’s slits

procedure: shine the light through the grating /Young’s slits
observation/conclusion; pattern on screen

* 1. **What is meant by polarisation?**
	polarisation is the restriction of (vibrating electromagnetic) waves to a single plane
	2. **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

Rotate one of the polaroid pieces

Observation/conclusion; the crossed pieces stop the light

* 1. **What three colours are used?**
	red, green, blue
	2. **Describe how these colours can be used to create any image.**
	these colours may be mixed (to give white light/ other colours)

**2018 no.9**

**(a)**

* 1. **State Coulomb’s law of force between charges.**
	Force proportional to the product of charges and inversely proportional to the distance between the charges squared
	2. **State one use of an electroscope.**
	test for charge, identify charge, measure potential
	3. **How can an electroscope be given a positive charge?**
	Touch the cap with a positively charged conductor

**OR**

Bring a negatively charged rod close to the cap and earth the electroscope.

Remove the earth before removing the rod

* 1. **What is observed when the cap of a charged electroscope is earthed?**
	The leaves collapse/converge / fall
	2. **Explain this observation.**
	Charges move (between the cap and the earth)
	3. **How could the cap of the electroscope be earthed?**
	by touching with a finger OR a conductor connected to earth

**(b)**

1. **State Ohm’s law.**

The current through a conductor is directly proportional to the voltage

1. **Calculate the total resistance of the circuit.**
6 + 12 = 18 Ω
2. **Calculate the current in the circuit.**

I = $\frac{V}{R}= \frac{3}{18}$ = 0.166 A

1. **Calculate the potential difference across the 6 Ω resistor.**

*V* = *IR* = (0.166)(6) = 1 V

1. **Name an instrument used to measure potential difference.**

voltmeter

**2018 no.10**

* 1. **What are X‐rays?**

High energy (high frequency) electromagnetic waves

* 1. **State two properties of X‐rays.**

Short wavelength, cause ionisation, affect photographic plates, absorbed by bone/metal, no charge, etc.

* 1. **What process occurs at part A?**
	Thermionic emission
	2. **Name a substance used in part B.**
	Tungsten
	3. **State the function of part C.**
	Prevent escape of X‐rays, shielding, protect (from X‐rays), etc.
	4. **State one use of X‐rays.**
	to photograph bones/ internal organs, to treat cancer, to detect flaws in materials, to determine the thickness of materials, etc.
	5. **Why is a vacuum needed inside an X‐ray tube?**
	So the electrons won’t collide and lose energy
	6. **Name another device that uses a beam of high speed electrons.**
	cathode ray tube, fluorescent light
	7. **State one use for the device you have named in part (vii).**
	CRO, medical devices, (old) TVs/screens
	8. **State one difference between X‐rays and gamma‐rays.**
	Different ways of production, different energy / wavelength /frequency/ penetration / ionising

**2018 no.11**

1. **What physical quantity is transmitted in a wave?**
Energy
2. **Why do waves break close to the shore?**
The wavelength decreases and the wave height (amplitude) increases

OR

Waves move into shallow water until the wave becomes unstable and breaks

1.  **Draw a diagram to show the main features of a wave.**

See diagram

1. **State Archimedes' principle.**
When a body is immersed in a fluid, the upthrust it experiences is equal to the weight of the fluid displaced
2. **What is meant by the term buoyancy (upthrust)?**
An upward force exerted by a fluid
3. **How does buoyancy help the surfer to stay afloat?**
counterbalances the weight
4. **Draw a labelled diagram to show the forces acting on a floating object.**
Diagram to show: weight down, upthrust up
5. **Explain how the stance of the surfer shown helps her to balance.**

Low centre of gravity OR wide stance

**2018 no.12**

**12 (a)**

1. **Define velocity.**
velocity is the rate of change of displacement OR velocity = displacement divided by time
2. **Define acceleration**.
Acceleration is the rate change in velocity OR acceleration = change in velocity divided by time taken.
3. **Calculate how long it took the train to reach its top speed.**
$$t=\frac{v-u}{a}= \frac{55-0}{0.4}$$

= 137.5 seconds

1. **How far did the train travel while at its top speed?**
s = (speed)(time) = (300)(55) = 16500 m



1. **Draw a velocity‐time graph of the train’s journey.**

See diagram

**12 (b)**

* 1. **How could you show the different colours present in visible light?**
	Apparatus: white light source, screen, prism/CD/grating

Shine the light through the prism/CD/grating

* 1. **What do the letters U and V stand for?**

Ultraviolet

* 1. **Compare the wavelength of UV radiation to the wavelength of infra‐red (IR) radiation.**
	ultraviolet has a shorter wavelength
	2. **Describe how to detect UV radiation.**
	Florescent material will fluoresce/glow
	3. **State one use of UV radiation.**
	Detect forged currency, disco lights, used in insect removal device, sterilisation, suntan, forensics, etc.

**12 (c)**

1. Calculate the energy needed to raise the temperature of the water from 20 0C to 90 0C.
Q = mcΔθ = (0.7)(4200) (90-20) = 205800 J
2. **How many joules of energy are supplied per second by the boiler?**
3000
3. **Calculate how long it will take the boiler to heat the water to 90 0C.**
Pork = Work/time so t = Work/Power t = 205800/3000 = 68.6 secs.
4. **Where should the manufacturer place the heating element of the boiler? Explain your answer.**
At the bottom, because cold water is more dense and will sink down

**12 (d)**

1. **What is electromagnetic induction?**
Electromagnetic Induction occurs when an emf is induced in a coil due to a changing magnetic flux.
2. **Explain how you would use a magnet and a coil, as shown above, to produce electricity.**
Move the magnet into/out of the coil
3. **How would you know that electricity is being produced?**
deflection /pointer moves / from the meter
4. **How could you increase the magnitude of the electricity produced?**
move faster / use a stronger magnet / use more coils
5. **What is meant by a.c.?**

Alternating current