**2014 Leaving Cert Physics Solutions (Ordinary Level)**

**2014 no.1**

1. **How did the student measure the upward forces?**

Using a newton-balance

1. **Copy the diagram and show all the forces acting on the metre stick.**
See diagram
2. **Find the total upward force acting on the metre stick.**
 9 + 12.5 = 21.5 N
3. **Find the total downward force acting on the metre stick.**

5 + 15 + 1.5 = 21.5 N

1. **Explain how these values verify one of the laws of equilibrium.**Forces are equal // sum of acting forces is zero // forces up = forces down
2. Find the sum of the anticlockwise moments of the upward forces about the 0 mark.
(9)(0.2) + (12.5)(0.9) = 1.8 + 11.25 = 13.05 N m
3. **Find the sum of the clockwise moments of the downward forces about the 0 mark.**(5)(0.36) + (1.5)(0.5) + (0.7)(15) = 1.8 + 0.75 + 10.5 = 13.05 N m
4. **Explain how these values verify the other law of equilibrium.**
moments are equal // sum of the moments equals zero

**2014 no.2**

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

labelled diagram to show:

calorimeter (with water)

thermometer // temperature sensor

ice 3

other detail e.g. insulation/(electronic) balance/stirrer, etc.

1. **What measurements would the student have taken for this experiment?**

mass of empty calorimeter

mass of calorimeter and water // mass of water

mass of calorimeter with water and ice // mass of (dried) ice

initial temperature of water

final temperature of water (and melted ice) // temperature difference

1. **How was the ice crushed?**
any valid method e.g. (place in a plastic bag/towel and hit) with a hammer // blended
2. **Why was the ice crushed?**
crushed ice melts faster // reference to larger surface area // to ensure all the ice is 0 °C
3. **Why was the experiment repeated?**
increase accuracy // to get average

**2014 no.3**

1. **Draw a labelled diagram of the apparatus used in the experiment.**
tuning fork(s) // signal generator 3
bridge(s) and metre stick / detail // bridges and magnet
2. **Indicate on your diagram the length of the string that was measured.**distance between bridges indicated
3. **Describe how the string could have been set vibrating.**
place a vibrating tuning fork on bridge // send signal from signal generator through it

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *f* (Hz) | 256 | 288 | 320 | 341 | 384 | 480 |
| *l* (m) | 0.80 | 0.71 | 0.64 | 0.60 | 0.53 | 0.43 |
| 1/*l* (m-1) | 1.25 | 1.41 | 1.56 | 1.67 | 1.89 | 2.33 |

1. **How was the frequency determined?**
read off the tuning fork
2. **Copy and complete the table into your answer book.**See table
3. **Draw a graph on graph paper of *f* on the *X*-axis against 1/*l* on the *Y*-axis.**



1. **What conclusion can be drawn from yourgraph?** *f* and *l* are inversely proportional

**2014 no.4**

1. **How was the voltage changed in this experiment?**
using the potential divider // by varying the resistance/the battery/power supply
2. What is the function of part X?
To measure current
3. **What is the function of part Y?**
To measure voltage
4. **What does the graph tell you about conduction in a diode?**
current varies linearly with voltage until 0.6 V // little current is conducted below 0.6 V,
after 0.6 V the current increases (rapidly) with voltage
5. **How would a student connect the diode in reverse bias?**
switch the polarity of battery / diode
6. **What is the function of the 330 Ω resistor?**
Protection / limit the current

**2014 no.5**

1. **A crane, powered by an electric motor, has a bucket that weighs 540 N when empty. The crane uses the bucket to lift 800 N of concrete up 75 m on a building site. Calculate the work done by the crane’s motor.**(540 + 800)(75) = ) 1.005 × 105 N m
2. **Which of the following are vector quantities and which are scalar quantities?**

Vectors: force, velocity

Scalars: mass, time

1. **Which of the following is used in the flash of a camera?**

capacitor

1. **What is the Doppler effect?**
apparent change in wave frequency due to motion of the wave source
2. **Name the lens shown and give an application of it.**
convex / converging lens used as a magnifying glass/(eye) glasses /binoculars/camera/etc.
3. **What is meant by the *U*-value of a material?**
measure of the heat flow through 1 m2 of material each second (perpendicular to the direction of flow) when a temperature difference of one degree exists between the two sides
4. **Name the component with the symbol shown in the diagram.**
light dependent resistor / LDR
5. **Name a piece of laboratory equipment used to separate white light into its colours.**
(glass) prism // (diffraction) grating
6. **How are X-rays produced?**
(when high speed) electrons hit a metal target
7. **Calculate the energy released each second.**
*E = m c*2 = (4× 109)(3 × 108)2 = 3.6 × 1026 J

**2014 no.6**

1. **Define force and give the unit of force.**
Force causes acceleration. Unit is the newton
2. **State Newton’s law of universal gravitation.**
states that any two point masses in the universe attract each other with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them.
3. **Calculate, to one decimal place, the acceleration due to gravity on Mars.**

*=* $g=\frac{GM}{d^{2}}= \frac{\left(6.67×10^{-11}\right)(6.4×10^{23})}{(3.4×10^{6})^{2}}=3.7 m s^{-2}$

1. **Give a reason for this.**
the rover weighs less on Mars // gravity is less on Mars // the mass of Mars is smaller than mass of Earth
2. **Calculate the weight of *Curiosity* on Earth**
*W = mg* = (899)(9.8) = 8.8 × 103 N
3. **Calculate the mass of *Curiosity* on Mars**
899 (kg) // the same as on Earth
4. **Calculate the weight of *Curiosity* on Mars.**
*W = mg* = (899)(3.7) = 3.3 × 103 N
5. **Name one other part of the electromagnetic spectrum.**
microwaves, infra-red, visible light, ultra-violet, X-rays, gamma rays

**2014 no.7**

(a)

1. **What is heat?**
Heat is a form of energy
2. **What is meant by temperature?**Temperature is a measure of hotness
3. **Give an example of a thermometric property.**
length (of a liquid column), resistance (of a thermistor / conductor), emf / voltage (generated by a thermocouple), colour (of certain crystals)
4. **The SI unit of temperature is the kelvin. Give another temperature scale.**
Celsius /°C // Fahrenheit /°F
5. **Express 310 K in the units of the scale you have named in part (*iv*).**
310 – 273 = 37± 0.2 °C

(*b*)

1. **How is heat transferred in metals?**
Conduction
2. **Name the two other methods of heat transfer.**
Convection and radiation
3. **How can this experiment be used to find out which of the metals is best at allowing heat transfer?**
Heat under the centre. The piece of wood which falls first indicates the best conductor
4. **State one way to make sure that this is a fair test.**
heat in the centre /ensure there is an equal amount of heat for each metal // ensure that the metal strips are the same length // ensure to have the same amount of wax, etc

**2014 no.8**

1. **Explain what is meant by reflection of light.**
Reflection is defined as the bouncing of light off an object
2. **State the laws of reflection of light.**
3. The incident ray, the normal at the point of incidence and the reflected ray all lie on the same plane.
4. The angle of incidence is equal to the angle of reflection.
5. **Give an application of reflection of light.**
mirror images, optic fibres, binoculars, endoscope, specific toys, etc
6. **Describe an experiment to demonstrate one of the laws of reflection of light.**
*apparatus*; raybox, mirror
*procedure*; mark position of rays, measure *i* and *r*
*observation/conclusion;* incident ray, reflected ray and normal in same plane and also *i* = *r*
7. **Explain what is meant by refraction of light.**
Refraction is the bending of a wave as it passes from one medium to another.
8. **What special name is given to the angle of incidence, *i*, when the effect shown in the diagram occurs?**
The critical angle
9. **Calculate the value of the refractive index of the glass**.

$$n=\frac{1}{\sin(c)}= \frac{1}{\sin(38)}=1.62$$



1. **Draw a diagram to show what happens to the ray of light when the angle of incidence is increased to 400.**

**2014 no.9**

1. **What is a magnetic field?**
A region in space where the magnetic force is experienced.
2. **How does a compass indicate the direction of a magnetic field?**
It experiences a force in a magnetic field and points in the direction of the field lines
3. **Describe an experiment to show that there is a magnetic field around a current-carrying conductor and sketch the field lines around the conductor.***apparatus;* power supply/ battery / voltage, conductor, compass *procedure;* set up the circuit / turn on the power supply / current *observation/conclusion*; compass deflects *field lines*; circular lines
4. **Sketch the magnetic field around a bar magnet.**
diagram to show magnet, field lines and correct direction
5. **What is observed when the magnet is moved towards the coil?**
needle / pointer / galvanometer deflects
6. **What is observed when the magnet is stationary?**
needle / pointer / galvanometer does not deflect
7. **Explain these observations.**
emf / voltage / current / electromagnetic induction due to changing magnetic field (around the coil)
8. **How would increasing the speed of movement of the magnet alter the observations?**
greater deflection/ emf // current is greater

**2014 no.10**

1. **What is meant by radioactivity?**
(spontaneous) emission of (one or more types of) particles/energy from the nuclei (of atoms)
2. **What does this experiment indicate about radiation?**
there are three different types // there is positive, negative and neutral radiation
3. **Which type of radiation is unaffected by electric fields?**
2 / gamma / γ
4. **Which type of radiation is positively charged?**
1 / alpha / α
5. **Which type of radiation is negatively charged?**
3 / beta / β
6. **Give the name of radiation types 1, 2 and 3, in that order.**
alpha, gamma, beta
7. **Name a suitable fuel for nuclear fission.**
(enriched) uranium/ U, plutonium / Pu, thorium / Th
8. **Explain the role of neutrons in nuclear fission.**
hit nucleus, are absorbed, cause fission / chain reaction
9. **Explain how the control rods can control the rate of fission, or stop the reaction completely.**
absorb neutrons // raise to increase // lower to decrease/stop
10. **What fraction of iodine–131 remains after 24 days?**
1/8th

**2014 no.11**

* 1. **Explain the term *evaporation*.**
	process by which a liquid absorbs heat and changes to a gas
	2. **What effect does the addition of heat have on the molecules of a liquid?**
	They move around faster
	3. **What happens to the temperature of a gas rising through the atmosphere?**
	it drops
	4. **What part does gravity play in the water cycle?**
	causes the liquid to fall back down to the earth
	5. **Explain the term *convection*.**
	causes the liquid to fall back down to the earth
	6. **What helps create the conductive path needed for lightning to occur?**
	cloud’s (strong) electric field
	7. **Name an instrument used in the laboratory to study static electricity.**
	electroscope / GLE // Van De Graaff generator // capacitor, etc
	8. **Why do we see the flash of lightning before we hear the thunder?**
	sound travels (much) slower than light

**2014 no.12 (a)**

1. **Explain the distinction between speed and velocity.**
velocity is speed in a given direction // velocity is a vector // sound is a scalar
2. **Calculate the time it took the bus to reach its top speed.**
v =u + at
*t = (v-u)/a* = (15 – 0 ) / 0.5 = 30 s
3. **Calculate the distance it travelled while at its top speed.**
*s*= *ut + ½ at2*
 *s* = (15)(100) = 1500 m
4. **Calculate the acceleration required to bring the bus to a stop**.
*a= (v – u ) / t* = (0– 15 ) / 20 = – 0.75 m s –2
5. **Sketch a velocity-time graph of the bus journey.**see graph

**2014 no.12 (b)**

1. **State the unit of pressure.**
Pa / N m-2
2. **Describe an experiment to demonstrate that the atmosphere exerts pressure.***apparatus:* glass of water and cardboard // can of water and heat source
*procedure:* place cardboard over glass and invert // boil water and put on lid
*observation/conclusion:* water remains in glass // can collapses
3. **State Archimedes’ principle.**
The upthrust (on a body immersed in a liquid) is equal to the weight of the liquid displaced.
4. **What is the upthrust (buoyancy force) on the object caused by the liquid?**
3 N
5. **Will the object float in the liquid if released?**
No
6. **Explain your answer.**
the upthrust is less than the weight, it is more dense, diagram shows it immersed

**2014 no.12 (c)**

1. **Name the distances labelled A and B.**
A = wavelength
B = amplitude
2. **What is the frequency of the wave?**20 Hz
3. **Calculate the velocity of the wave if distance A = 1.5 m.**
*v = f λ* = (20)(1.5) = ) 30 m s-1
4. **Name a type of wave that cannot be polarised.**
longitudinal // sound // pressure

**2013 no.12 (d)**

1. **State Ohm’s law.**
*V = IR*
2. **What is the total resistance of the circuit?**
500 (Ω)
3. **What is the current in the circuit?**I = V/R = 6/500 = 1.2 × 10-3 A
4. **What is the potential difference across the 50 Ω resistor?**
*V = IR* = (1.2 × 10-3)(50) = 0.6 V
5. **What would happen to the resistance of the circuit if the temperature were increased?**
It would decrease