National 5 Homework One

1. Copy and complete the following passage.

The basic structure of an atom consists of a nucleus which is orbited by _____.
Inside the nucleus there are particles called _____ and _____. A _____ atom has
no overall charge because the number of _____ is equal to the number of _____.

(3)

2. Explain how a polythene rod can become negatively charged.

(2)

3. What happens when two negatively charges objects are placed near to each other?

(1)

4. Which Physics term is defined as "the electrical charge transferred per unit time"?

(1)

5. A heater draws a current of 5A. If it is switched on for 50seconds, how much
charge will flow?

(3)

National 5 Homework Two

1. A lighting strike lasts for 20milliseconds and delivers 50C of charge. What current
flows during this time?

(3)

2. How long would it take a current of 15A to build up 4.5kC of charge?

(3)

3. Explain the difference between a.c. and d.c.. Your explanation must include the
terms "electron" and "direction".

(2)

4. For each of the following traces, state if they are a.c. or d.c.

(2)
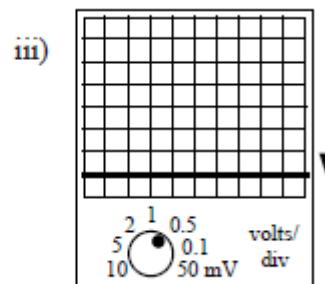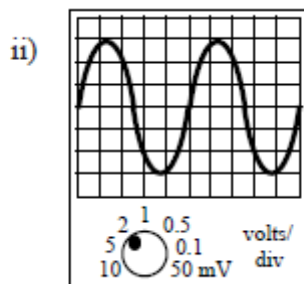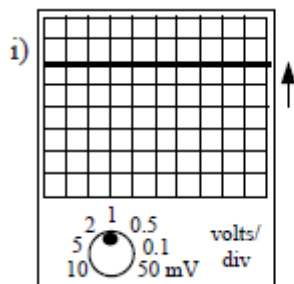
National 5 Homework Three

1. Copy and complete the following.
A negative point _____ will have an electric field around it. When a positively charged particle enters the electric field it will experience a _____ acting on it, which will make it move _____ the electric field.

(3)

2. a) Copy the diagram below and add the electric field lines to show that the field between the plates is uniform.

(2)

Path of particle

+ + + +

- - - -
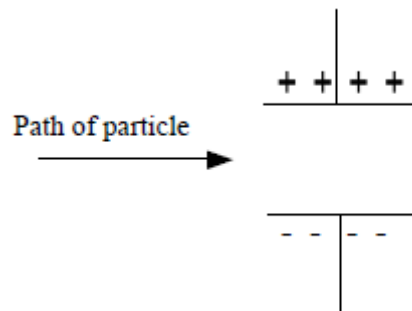
b) Complete the above diagram to show the path of the particle through the uniform field if it is negatively charged.

(1)

3. Draw the electric field pattern around each of the following point charges.

(a) ⊕   (b) ⊖

(4)

National 5 Homework Four

1. Copy and complete the following statements about potential difference
The potential difference (voltage) of a supply is a measure of the _____ given to a _____ carrier in the circuit.
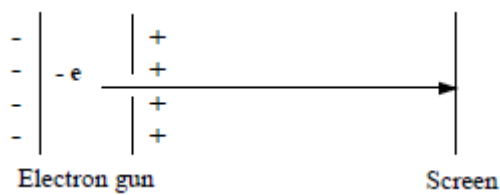Potential difference is the _____ _____ in moving a unit _____.

(4)

2. What is the potential difference between two points, if 5.0J of work is needed to move a 25mC charge between the two points?

(3)

3. Electrons are fired from an "electron gun", then through a vacuum towards a screen.
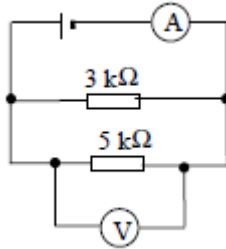

Electron gun   Screen

If the p.d. across the gun is 5kV and the electrons have a charge of 1.6×10^{-19}C, how much work is done in moving them to the screen?
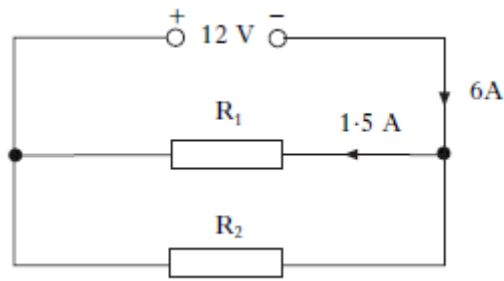
(3)

National 5 Homework Five

1. a) In the following circuit, which resistor has the greater current flowing through it?

(1)

b) In the above circuit is the reading on the voltmeter reading **greater than, the same as or less than** the supply p.d. of 3.75V.

(1)

2. The following circuit is set up.

What is the current in, and the potential difference across resistor R$_2$?

(2)

3. The circuit shown is used to control the brightness of two identical lamps. The variable resistor is adjusted until the lamps operate at their rated voltage of 3.0V.
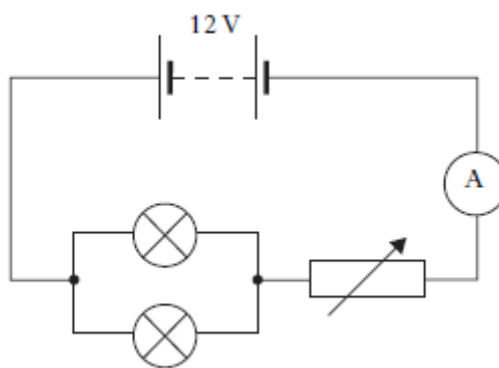
a) If the reading on the ammeter is 1.2A, what is the current in **one** lamp?
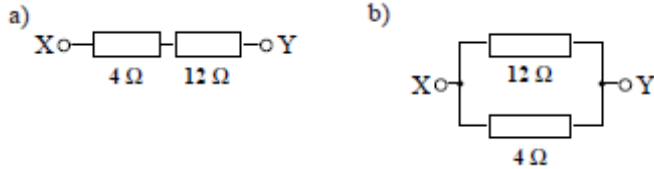
(1)

b) Calculate the resistance of **one** lamp.

(3)

c) If one of the lamps is removed, explain what will happen to the reading on the ammeter.
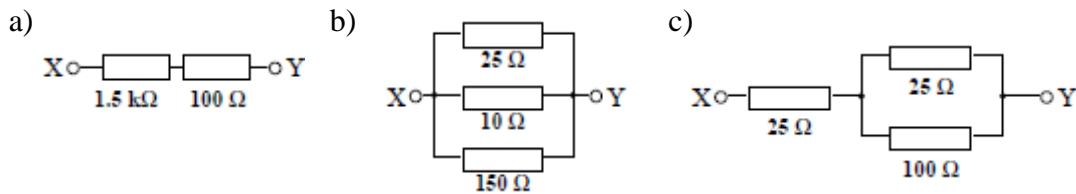
(2)

National 5 Homework Six

1. Which of the following circuits – a) or b) - will have the greater total resistance? (No calculations should be needed!)

(1)

2. Calculate the total resistance between X and Y for the following circuits.
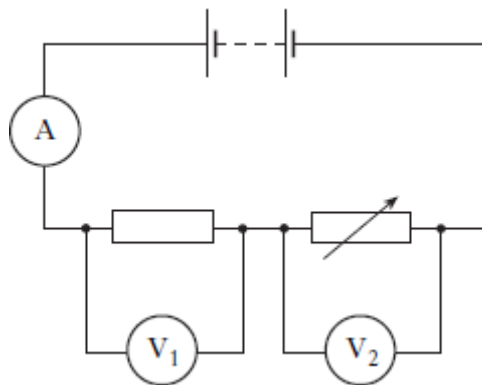
(9)

National 5 Homework Seven

1. Copy and complete the following table:-

Component	Symbol	Useful Energy Change
LED		electrical to
Loudspeaker		electrical to
Motor		electrical to

(3)

2. A circuit is set up as shown below.

If the resistance of the variable is increased, what happens to the readings on the three meters?

(3)

3. Copy and complete the following statements:-
   a) When the temperature across a thermistor decreases, its resistance will _____.
   b) When the light level is increased on an LDR, its resistance will _____.
   c) A _____ is a device that can be used to store electrical charge.
   d) A _____ is a device that will protect an appliance when excess current flows.

(4)

National 5 Homework Eight

1. The following circuit is set up.
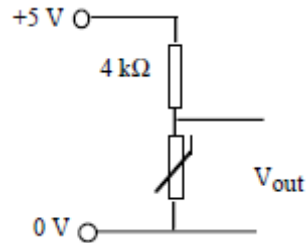
a) When the temperature rises, what happens to the value of V_{out}.

(1)

b) The thermistor and the resistor are interchanged. What happens to the value of V_{out} as the temperature decreases.

(1)

c) When the total resistance of the circuit is 10kΩ, calculate the current in the thermistor.

(3)

2. Name the components which have the following symbols.

a)
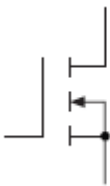
b)
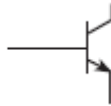
(2)

3. An automatic window blind operates when the light level outside gets to high. The electronic circuit that operates the blind is shown below.

Explain how this circuit works to close the blind.

(3)

National 5 Homework Nine

1. If an electric fire uses 0.8MJ of energy in a time of 5minutes, calculate the power output of the fire.
(3)

2. If a filament lamp of power rating 40W is used for 2hrs, how much electrical energy will have been supplied?
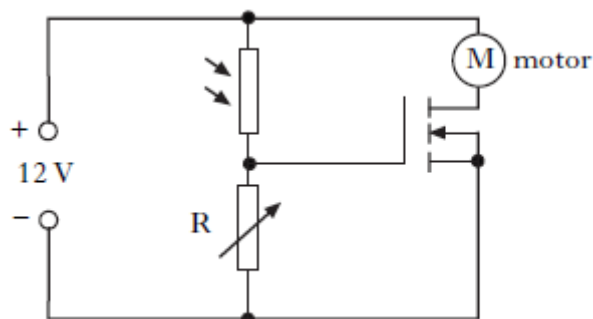(3)

3. A toaster connected to a 230V mains supply draws a current of 5A. Calculate the power of the toaster.
(3)

4. A 15Ω resistor is connected to a power output of 0.6W. How much current will flow through the resistor?
(3)

5. A 6250Ω resistor is connected to a power output of 40W. What is the potential difference across the resistor?
(3)

National 5 Homework Ten

1. Which Physics term is defined as "the heat energy required to change the temperature of 1kg of a substance by 1^0C"?
(1)

2. An electric kettle is used to heat 0.4kg of water. The initial temperature of the water is 15^0C. Calculate how much heat energy is required to bring the water to its boiling point of 100^0C. (c_{water} = 4180Jkg^{-10}C^{-1})
(3)

3. Calculate the amount of heat energy required to melt 0.3kg of ice at 0^0C.
(Specific latent heat of fusion of ice = 3.34 x 10^5 Jkg^{-1})
(3)

4. A box exerts a downwards force of 120N, and has a base area of 2m^2. Calculate the pressure the box exerts on the ground.
(3)

National 5 Homework 11

1. What is the value of absolute zero on the degrees Celsius scale?
(1)

2. Give the value of the following Kelvin temperatures in ^{0}C.
a) 310K   b) 373K   c) 250K
(2)

3. A balloon contains 1.5m^3 of helium at a pressure of 100,000Pa and a temperature of 300K. If the pressure is increased to 250,000Pa at a temperature of 400K, calculate the new volume of the balloon.
(3)

4. A rigid cylinder containing helium gas is accidentally placed in front of a warm radiator. Use the kinetic model to explain what will happen to the pressure of the gas inside the rigid cylinder.
(2)

5. The kinetic model can be used to explain the relationship between pressure and temperature of a fixed mass of gas. Display this relationship in graphical form.
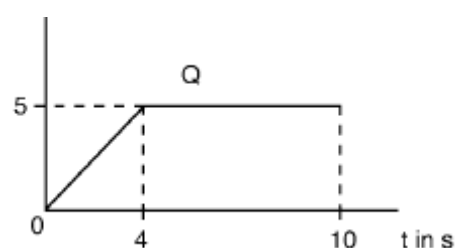(2)

National 5 Homework 12

1. Shown below are the velocity-time graphs for three boys – P, Q and R – involved in a race against each other.

velocity in ms^{-1}
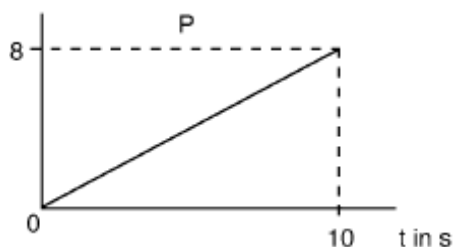
velocity in ms^{-1}

velocity in ms^{-1}
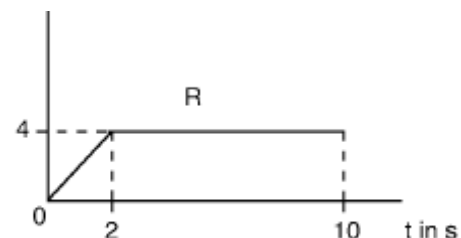
a) Which boy maintained a constant acceleration throughout the race?
b) Which boy maintained a constant velocity for the longest time?
c) Which boy was travelling fastest after 4seconds?

(3)

2. Draw the velocity-time graph described by these statements:-
The object starts from rest and accelerates for 5seconds reaching a final velocity of 12ms^{-1}. The object then continues at 12ms^{-1} for another 8seconds. The object then slows down to rest in 7seconds.

(4)

3. A cyclist is approaching a set of traffic lights. The graph shows how the velocity of the cyclist varies with time from the instant she sees the traffic lights change to red.

velocity in ms^{-1}

time in s

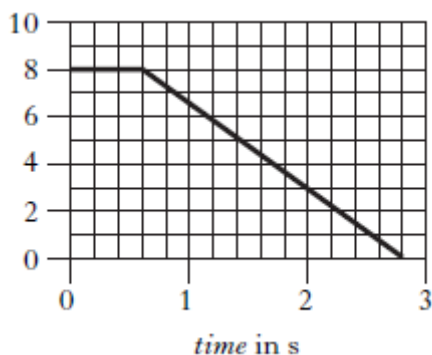Calculate the displacement of the cyclist from seeing the lights change to red until she comes to rest.

(3)

National 5 Homework 13

1. The graph below shows how the velocity of a ball varies with time.

velocity in ms^{-1}

time (s)
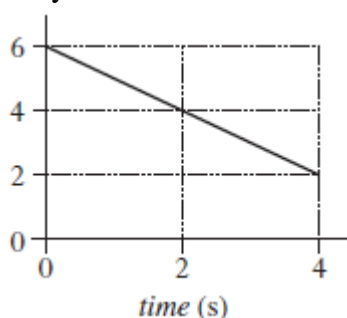
Calculate the acceleration of the ball.

(3)

2. For the first 0.8s of its motion, the acceleration of a bowling ball is 2ms^{-2}. Assuming it started from rest, calculate its velocity after 0.8s.

(3)

3. Explain how you would use the following apparatus to find the acceleration of a trolley.

- Ramp
- Two light gates
- Computer
- Trolley with card on top

Your description should clearly show an understanding of any necessary equations.

(4)

National 5 Homework 14

1. The two blocks – A and B – shown below have more than one force acting on them and are moving to the right.

2 N← [A] →4 N   4 N← [B] →16 N
2 N←

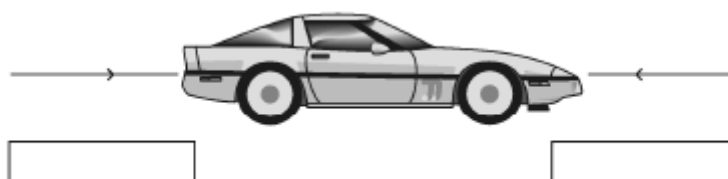By quoting Newton's Laws, explain the motion of each block.

(4)

2. The car shown below is travelling with a constant velocity.

Name the two forces acting on the car.

(2)

3. A car of mass 1200kg, experiences a frictional force of 500N when the engine force is 1400N. Calculate the acceleration of the car.

(4)

National 5 Homework 15

1. Calculate the work done in moving an object 4m, by applying an unbalanced force of 100N.

(3)

2. A skydiver, total mass 85kg, is falling vertically on planet Earth.

a) Calculate the weight of the skydiver.

(3)

At one point during the fall the air friction is 153N.

b) State the unbalanced force acting on the skydiver at this point in the fall.

(1)

c) Calculate the acceleration of the skydiver at this point in the fall.

(3)

National 5 Homework 16

1. A Physics teacher, mass 60kg, wins a competition to visit Mars which has a gravitational field strength of $3.7Nkg^{-1}$. Calculate the teacher's weight on Mars.

(3)

2. The graph below shows the motion of a parachutist from leaving the aircraft until landing.

velocity in ms^{-1}

time in s
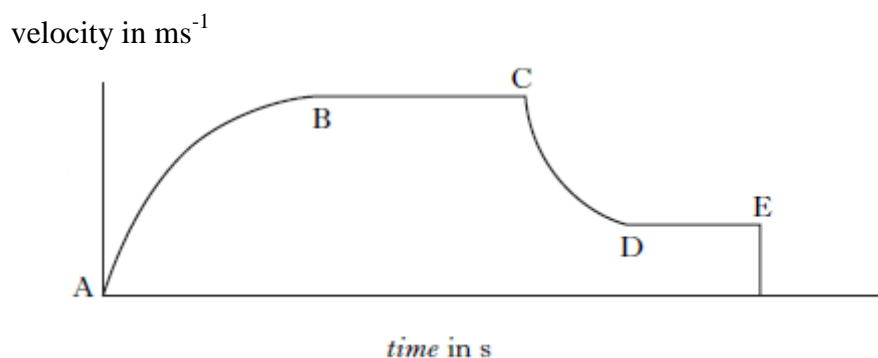
a) What term is given to the velocity at points B and D in the graph?

(1)

b) Using Newton's Laws, explain why sections B to C and D to E are horizontal lines.

(2)

3. A rocket has an unbalanced force 80,000N acting on it when it takes off from Planet X.

a) If the mass of the rocket is 40,000kg, calculate its initial acceleration.

(3)

b) The initial weight of the rocket is 360,000N. State the engine force at take off.

(1)

National 5 Homework 17

1. Copy and complete the following statements.
A projectile has two separate motions. The horizontal motion has a constant _____. The vertical motion has a constant _____.

(2)

2. The graphs shown below represent the horizontal and vertical motion of a projectile.

Graph A   Graph B
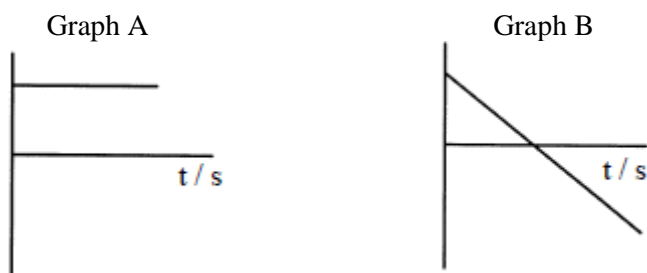
Copy and complete these graphs by adding the correct labels – horizontal velocity and vertical velocity – to the y-axis.

(2)

3. An aircraft is flying horizontally at 110ms-1 when it drops supplies in a relief operation. The package takes 8s to reach the ground.
a) Calculate how far the package travels horizontally before hitting the ground.

(3)

b) Calculate the vertical velocity of the package when it reaches the ground.

(3)

National 5 Homework 18

1. Name the terms A, B, C, D and E that are missing from the following table.

Term	Definition
A	A large object moving in an orbit round a star
B	A collection of galaxies.
C	The distance light travels in one year.
D	A small object which orbits a larger object
E	A planet that is outside our Solar System.

(5)

2. Copy and complete the following passage about data collection from space.
Satellites and telescopes are often used to collect data from space.
Satellites can detect long wavelength _____ waves as well as high energy _____ rays. An _____ telescope uses _____ light to collect data and the Hubble Space Telescope is an example of a _____ telescope.

(5)

National 5 Homework 19

1. The spacecraft (mass 2×10^6kg) shown below is used to transport astronauts and equipment to a space station. For re-enter to Earth's atmosphere the underside of the spacecraft has a heat shield made from silica tiles.


The mass of the heat shield is 3.5×10^3kg.

a) If the gain in heat energy is 4.7×10^9J, calculate the increase in temperature of the silica tiles. ($c_{silica} = 1033$J kg^{-1} ^{0}C^{-1})

(3)

b) After re-entry the spacecraft lands on a runway like a plane. At the point of touchdown on the runway the spacecraft is travelling at 100ms^{-1}. Calculate the kinetic energy of the spacecraft at touchdown.

(3)

c) The spacecraft travels a distance of 2000m on the runway before coming to rest. Calculate the force needed to bring the spacecraft to rest.

(3)

d) During re-entry and touchdown an aluminium component (mass 0.5kg) on the outside of the spacecraft melted. Calculate the energy needed to melt this component. (specific latent heat of fusion of aluminium 3.95×10^5 J kg^{-1})

(3)

e) When the spacecraft is at rest, the melted aluminium component falls 5m on to the runway. Calculate the gravitational potential energy lost by the component.

(3)

National 5 Homework 20

1. The following diagram gives information about a wave.
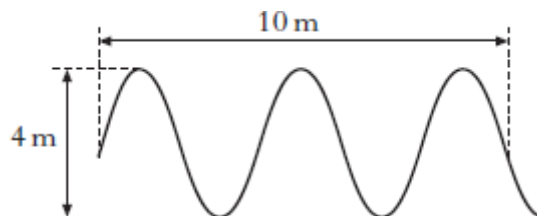
a) State the amplitude of this wave.
b) State the wavelength of this wave.

(2)

2. Copy and complete the following sentences about types of waves:-
   - The particles of a _____ wave vibrate at 90° to the direction of the wave.
   - The particles of a _____ wave vibrate along the same line as the direction of the wave.
   - Water waves and X-rays are examples of _____ waves.
   - Sound waves are an example of a _____ wave.

(4)

3. Parking sensors are fitted to the rear bumpers of some cars.


emitters and sensors
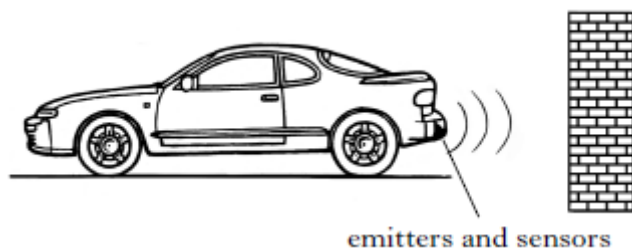
Ultrasonic pulses, which travel at 340ms^{-1}, are emitted from the rear of the car. Objects behind the car reflect the pulses, which are detected by sensors. The time between pulses being emitted and detected is 2 x 10^{-3}s.
Calculate the distance between the object and the rear of the car.

(4)

National 5 Homework 21

1. A hill lies between a radio and television transmitter and a house.
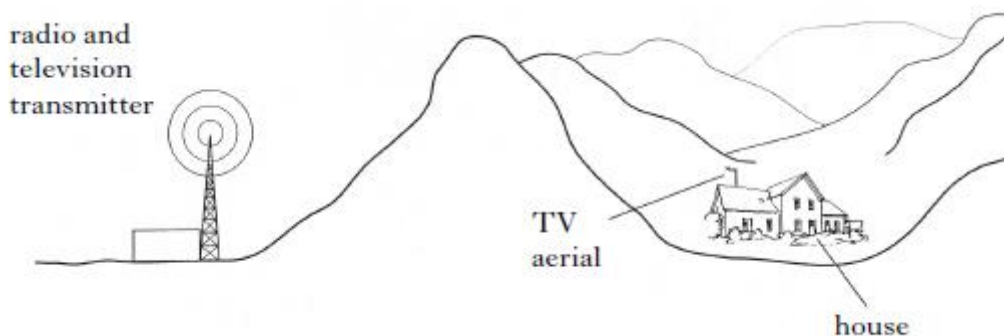
The house is within the range of both the radio and the television signals from the transmitter.

a) Explain why, in the house, there is a good radio reception but a poor television reception from the transmitter.

(2)

b) The television signals are carried by microwaves which have a frequency of 1.2×10^{10}Hz. Calculate the wavelength of the television signals.

(4)

2. The diagram shows the members of the EM spectrum.

gamma rays	P	ultraviolet	Q	infrared	R	TV and Radio

Use members P, Q and R to answer the following.

a) Which member has the longest wavelength?
b) Which member has the highest frequency?
c) Which member is most likely to be detected by a dish aerial?
d) Which member is most likely to cause cell damage?

(4)

National 5 Homework 22

1. Copy and complete the following passage about refraction of light.

When light passes from one medium to another, e.g. air to glass, there will be a change of _____. This is due to the _____ of light being less in glass than air. The light ray will bend _____ the normal. When the light ray moves from glass to air it will bend _____ _____ the normal.

(4)

2. The diagram below shows what happens to a ray of light when it strikes a glass block.
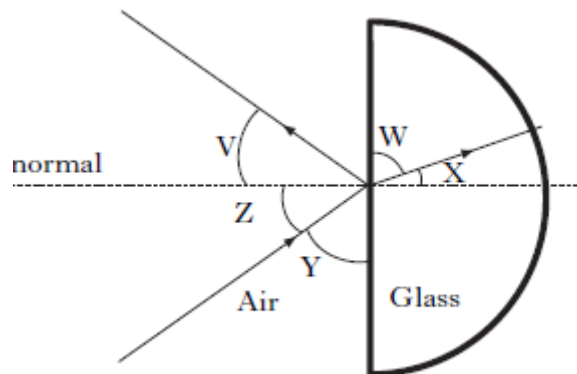
a) Which letter represents the angle of incidence?
b) Which letter represents the angle of refraction?

(2)

3. Copy and complete the following passage:-

People who are long sighted have difficulty seeing _____ objects. To rectify long sight a _____ lens can be used. People who are short sighted have difficulty seeing _____objects. To rectify short sight a _____ lens can be used.

(4)

National 5 Homework 23

1. The diagram below shows a simple model of an atom.
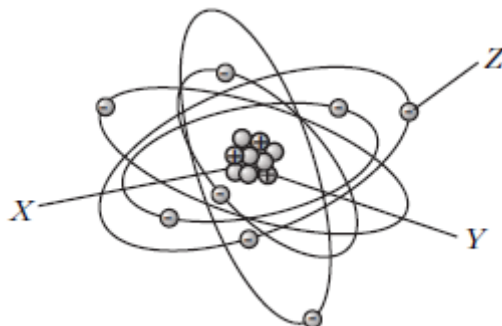
Write down the names of particles X, Y and Z?

(3)

2. Copy and complete the following table about nuclear radiations.

Type	Description	Absorbed by
	Helium nucleus	Thin paper
Beta	Fast moving electron	
		Thick lead

(4)

3. Explain what happens in the process called ionisation?

(2)

4. Which term is used to describe the radiation that is always present in our atmosphere?

(1)

National 5 Homework 24

1. Copy the following table by matching the quantities with their units.

Quantity	Unit
Absorbed Dose	Becquerel
Activity	Gray
Dose Equivalent	Sievert

(3)

2. What does the risk of biological harm from radiation depend on?

(3)

3. The table shows the count rate of a radioactive source taken at regular time intervals. The count rate has been corrected for background radiation.

Time (minutes)	10	20	30	40	50
Count rate (counts per minute)	800	630	500	400	315

What is the half-life of the radioactive source?

(2)

4. In the following passage two words have been replaced with the letters X and Y.
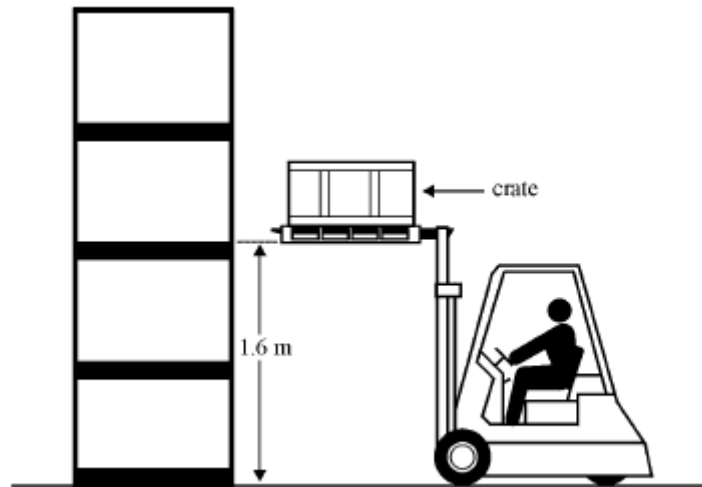
Nuclear fission is caused by the X bombardment of a uranium nucleus. This causes the uranium nucleus to split releasing neutrons and Y.

Which words have been replaced by X and Y?

(2)

National Five Homework 25

A fork lift truck lifts a crate of mass 150kg onto a shelf in a warehouse. The crate is lifted a vertical distance of 1.6m at a constant speed.

a) Calculate the gain in gravitational potential energy of the crate after it has been raised by the fork lift truck.

(3)

b) The fork lift supplies 3600J of energy during the lifting process. Calculate the efficiency of the lifting process.

(3)

c) State two types of "wasted" energy that are produced by the fork lift truck during the lifting process.

(1)

d) If the crate falls of the shelf, with what speed will it hit the ground?

(3)