GCSE ADDITIONAL PHYSICS (P2) REVISION BOOKLET

Name _____

These are summary questions for all topics in the GCSE Physics exam. When you have completed the booklet go to the School's website and find the relevant mark scheme and mark your work. Check off each section and enter your score.
If you find a section(s) produce low scores you can:

- **Come to catch up and ask for help**
- **Go online:**
  - **http://www.bbc.co.uk/schools/bitesize/**
  - **http://www.s-cool.co.uk/**
  - **http://web.aqa.org.uk/qual/newgcses/science/new/bio_materials.php?id=03&prev=03**
- **Use your notes and revision guides**
- **You can purchase revision guides from Mrs Fuller in the main science prep room.**

All the above will identify areas of weakness and give you strategies to swat up on.

	Score	Date	Grade	%	
P2.1 Motion	/18			90+	A*
P2.2 Speeding up slowing down	/30			80	A
P2.3 Work, energy momentum	/25			70	B
P2.4 Static Electricity	/21			60	C
P2.5 Current Electricity	/18			50	D
P2.6 Mains Electricity	/29			40	E
P2.7 Nuclear Physics	/38			30	F
End of unit exam	/29			20	G

Name: **Class:**

Summary questions

Complete the sentences below.

1 a) Speed (m/s) = $\frac{\text{.....(....)}}{\text{.....(....)}}$

b) The steeper a distance–time graph is, the greater the ……..…… it represents.

c) The slope of a distance–time graph represents ……..……

d) In Figure 1 below:

i) Line X represents …….... speed because the slope of the line is ……..…

ii) Line Y represents …….... speed because the slope of the line is ……...

[Higher]

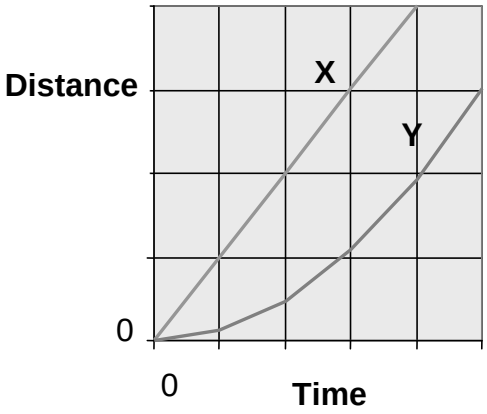


Figure 1

a) Velocity is speed in a given ……..……

b) Acceleration is change of ……..…… per second.

c) Acceleration (m/s^2) = $\frac{\text{change of .....(.....)}}{\text{time taken (seconds, s)}}$

d) The slope of the line on a velocity–time graph represents ……..…….

e) The area under the line on a velocity–time graph represents ……..…….

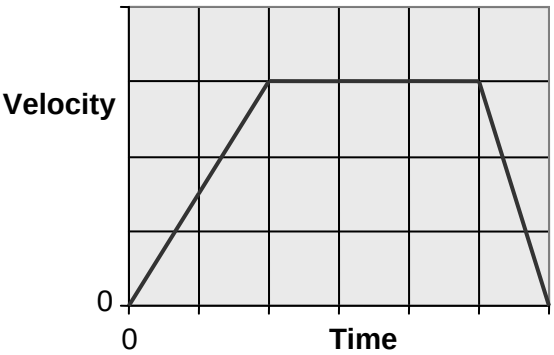
f) The graph below represents the motion of an object that:

i) started off at ……..…… speed, then

ii) accelerated at ……..…… acceleration,

iii) then moved at ……..…… acceleration,

iv) then decelerated at ……..…… deceleration.



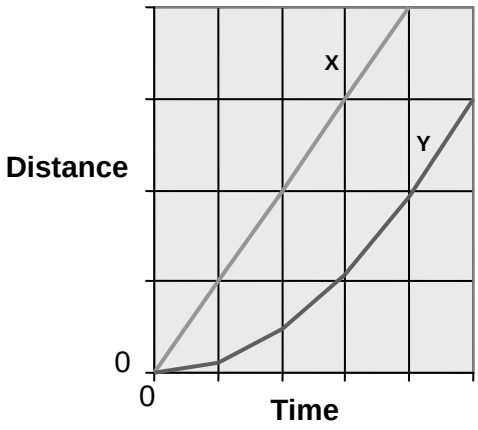
Total = ___/18

1 mark for each word/phrase in bold

Answers to summary questions

1 a) Speed (m/s) = $\frac{\textbf{distance travelled (m)}}{\textbf{time taken (s)}}$

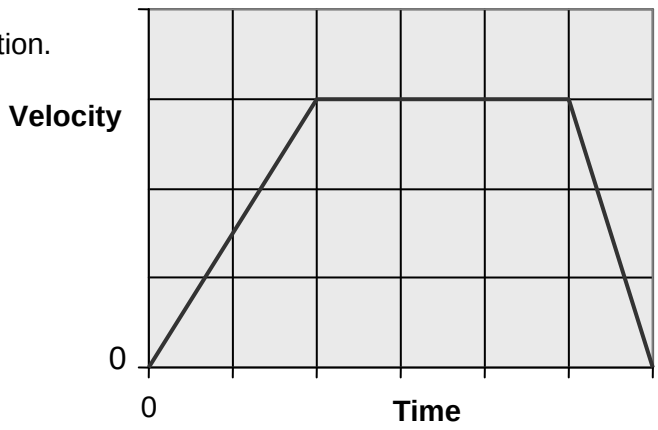
b) The steeper a distance–time graph is, the greater the **speed** it represents.
c) The slope of a distance–time graph represents **speed**.
d) In Figure 1 below:
i) Line X represents **constant** speed because the slope of the line is **constant**.
ii) Line Y represents **increasing** speed because the slope of the line is i**ncreasing.**



2 a) Velocity is speed in a given **direction**.
b) Acceleration is change of **velocity** per second

c) Acceleration (m/s^2) = $\frac{\text{change of } \textbf{velocity (m/s)}}{\text{time taken (second, s)}}$ ***1 mark for vel 1 mark for unit***

d) The slope of the line on a velocity–time graph represents **acceleration**.
e) The area under the line on a velocity–time graph represents **distance travelled**.
f) The graph below represents the motion of an object that:
i) started off at **zero** speed, then
ii) accelerated at **constant** acceleration,
iii) then moved at **zero** acceleration,
iv) then decelerated at **constant** deceleration.



Total = 18

AQA Science

P2.2 Speeding up slowing down
Summary sheet

Name: **Class:**

Summary questions

Complete the sentences below.

1 a) When two objects interact, they exert ……. and ……. forces on each other.

b) The unit of force is the ……. (symbol …..).

c) A moving object acted on by a resultant force:

i) in the same direction as the direction of its motion ……..,

ii) in the opposite direction to its direction of motion …….. .

d) Resultant force = …….. × ……..

(in ……) (in kg) (in ……)

2 a) i) Thinking distance is the distance travelled by the vehicle in the time it takes ……. .

ii) Braking distance is the distance the vehicle travels ……. .

iii) ……. distance = the thinking distance + the braking distance.

b) i) Three factors affecting thinking distance include ……..., …….. and ……... .

ii) Three factors affecting braking distance include ……..., …….. and ……... .

3 a) The force of gravity on a …….. object is the gravitational field strength at the place where the object is.

b) The value of the Earth's gravitational field strength at its surface is about ……...

c) i) The weight of an object is the force of …….. on it.

ii) weight = …….. × …….

(in ……) (in kg) (in ……)

d) An object falling freely accelerates at ……... .

e) An object falling in a fluid reaches a ……. .

Total _____/30

P2.2 Speeding up slowing down
Summary sheet

1 mark for each word/phrase in bold

Answers to summary questions

1 a) When two objects interact, they exert **equal** and **opposite** forces on each other.
b) The unit of force is the **newton** (symbol **N**).
c) A moving object acted on by a resultant force:
i) in the same direction as the direction of its motion **accelerates**.
ii) in the opposite direction to its direction of motion **decelerates**.
d) Resultant force = **mass** × **acceleration**
(in **N**) (in kg) (in **m/s^2**)

2 a) i) Thinking distance is the distance travelled by the vehicle in the time it takes **the driver to react**.
ii) Braking distance is the distance the vehicle travels **under the braking force**.
iii) **Stopping** distance = the thinking distance + the braking distance.
b) i) Three factors affecting thinking distance include **tiredness**, **drugs** and **alcohol**.
ii) Three factors affecting braking distance include **poorly maintained brakes** and **tyres** and **road conditions**.

3 a) The force of gravity on a **1 kg object** is the gravitational field strength at the place where the object is.
b) The value of the Earth's gravitational field strength at its surface is about **10 N/kg**. *1mark for answer 1 mark for unit*
c) i) The weight of an object is the force of **gravity** on it.
ii) weight = **mass** × **gravitational field strength**
(in **N**) (in kg) (in **N/kg**)
d) An object falling freely accelerates at **10 m/s^2**. *1mark for answer 1 mark for unit*
e) An object falling in a fluid reaches a **terminal velocity**.

Total 30 marks

Name: **Class:**

Summary questions

Complete the sentences below.

1 a) Work done = ……. transferred.

b) Work done = ……. × …….

(in ……..) (in ……..) (in m)

c) When an object is raised or lowered, its change of gravitational potential energy = ……. × …….

(in ……..) (in ……..) (in m)

d) Elastic potential energy is the energy stored in an ……. object when work is done on the object.

e) The kinetic energy of a moving object depends on its …… and its …… .

f) Kinetic energy = ½ × ……. × ……. [Higher]

(in ……..) (in kg) (in (……..)^2)

2 a) Momentum (in……) = …… (in kg) ×…… (in m/s)

b) Momentum is conserved whenever objects interact provided ……. ……. .

c) Momentum has size and ……. .

d) When two bodies push each other apart, they move apart with equal and opposite ……. .

e) The more time an impact takes, the …… the force exerted.

f) Force (in newtons) = $\frac{\text{.....(in .....)}}{\text{time taken (in seconds)}}$

Total _____/25

P2.3 Work, Energy, Momentum
Summary sheet

1 mark for each word/phrase in bold

Answers to summary questions

1 a) Work done = **energy** transferred

b) Work done = **force** (in **J**) × **distance moved in the direction of the force** (in **N**) (in m)

c) When an object is raised or lowered, its change of gravitational potential energy = **weight of object** (in **J**) × **change of height of object** (in **N**) (in m)

d) Elastic potential energy is the energy stored in an **elastic** object when work is done on the object.

e) The kinetic energy of a moving object depends on its **mass** and its **speed**.

f) Kinetic energy = ½ × **mass** (in **J**) × **speed**^{2} (in kg) (in (**m/s**)^2)

2 a) Momentum (in **kg m/s**) = **mass** (in kg) × **velocity** (in m/s)

b) Momentum is conserved whenever objects interact provided **no external forces act on them**.

c) Momentum has size and **direction**.

d) When two bodies push each other apart, they move apart with equal and opposite **momentum**.

e) The more time an impact takes, the **less** the force exerted.

f) Force (in newtons) = $\frac{\textbf{change of momentum (in kg m/s)}}{\text{time taken (seconds)}}$

Total 25 marks

Name: **Class:**

Summary questions

Complete the sentences below.

1 a) The protons and neutrons make up the …….. of the atom. …….. move about in the space round the nucleus. An uncharged atom has equal numbers of …….. and ……... .

b) A proton has a …….. charge. An electron has an equal …….. charge. A neutron is ……... .

c) i) Adding electrons to an uncharged atom makes it ……... .

ii) Removing electrons from an uncharged atom makes it ……... .

2 a) Like charges ……..; unlike charges ……... .

b) i) Insulating materials that lose electrons when rubbed become …….. charged.

ii) Insulating materials that gain electrons when rubbed become …….. charged.

c) An electric current is a flow of ……... .

d) An isolated metal object that is initially uncharged will …….. charge if it is brought into contact with a charged object.

e) A metal object is earthed by connecting it to ……... .

3 a) Applications of electrostatics include the electrostatic …….. sprayer, the electrostatic …….. to remove smoke and dust particles from flue gases and the photocopier.

b) i) A spark from a charged object can make powder grains or certain gases ……... .

ii) To eliminate static electricity**,** use …….. materials and earth metal pipes and objects (i.e. connect them to ……..).

1 mark for each word/phrase in bold

Answer to summary questions

1 a) The protons and neutrons make up the **nucleus** of the atom. **Electrons** move about in the space round the nucleus. An uncharged atom has equal numbers of **electrons** and **protons**.
   b) A proton has a **positive** charge. An electron has an equal **negative** charge. A neutron is **uncharged**.
   c) i) Adding electrons to an uncharged atom makes it **negative**.
      ii) Removing electrons from an uncharged atom makes it **positive**.

2 a) Like charges **repel**; unlike charges **attract**.
   b) i) Insulating materials that lose electrons when rubbed become **positively** charged.
      ii) Insulating materials that gain electrons when rubbed become **negatively** charged.
   c) An electric current is a flow of **charge**.
   d) An isolated metal object that is initially uncharged will **gain** charge if it is brought into contact with a charged object.
   e) A metal object is earthed by connecting it to **the ground**.

3 a) Applications of electrostatics include the electrostatic **paint** sprayer, the electrostatic **precipitator** to remove smoke and dust particles from flue gases and the photocopier.
   b) i) A spark from a charged object can make powder grains or certain gases **explode**.
      ii) To eliminate static electricity**,** use **antistatic** materials and earth metal pipes and objects (i.e. connect them to **the ground**).

Total marks 21

Name: **Class:**

Summary questions

Complete the sentences below

1 a) i) A circuit diagram shows how …… are connected together.

ii) A …… consists of two or more cells connected together.

b) i) Resistance = …… (in ……)
(in ohms) …… (in ……)

ii) The current through a resistor at constant temperature is directly …… to the potential difference across the resistor.

2 a) The resistance of a filament lamp …… with increase of the filament temperature.

b) For a diode, its 'forward' resistance is …… and its 'reverse' resistance is …… .

c) The resistance of a thermistor decreases if its temperature …… .

d) The resistance of an LDR …… if the light intensity on it increases.

3 For components in series:

a) the current is …… in each component.

b) the potential differences …… to give the total potential difference.

c) the resistances …… to give the total resistance.

4 For components in parallel:

a) the potential difference is …… in each component.

b) the total current is the …… of the currents through each component.

c) the bigger the resistance of a component, the …… its current is.

Total ___/18

1 mark for each word/phrase in bold

Answer to summary questions

1 a) i) A circuit diagram shows how **components** are connected together.
ii) A **battery** consists of two or more cells connected together.

b) i) Resistance (in ohms) = $\frac{\textbf{potential difference} \text{ (in } \textbf{volts}\text{)}}{\textbf{current} \text{ (in } \textbf{amperes}\text{)}}$
ii) The current through a resistor at constant temperature is directly **proportional** to the potential difference across the resistor.

2 a) The resistance of a filament lamp **increases** with increase of the filament temperature.
b) For a diode, its 'forward' resistance is **low** and its 'reverse' resistance is **high**.
c) The resistance of a thermistor decreases if its temperature **increases**.
d) The resistance of an LDR **decreases** if the light intensity on it increases.

3 For components in series:
a) the current is **the same** in each component.
b) the potential differences **add** to give the total potential difference.
c) the resistances **add** to give the total resistance.

4 For components in parallel:
a) the potential difference is **the same** in each component.
b) the total current is the **sum** of the currents through each component.
c) the bigger the resistance of a component, the **smaller** its current is.

Total 18 marks

Name: **Class:**

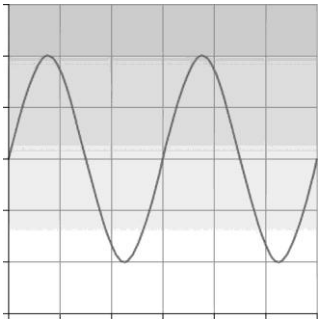
Summary questions

Complete the sentences below.

1 a) Mains electricity is an alternating current supply. Alternating current repeatedly …….. its direction.

b) A mains circuit has a …….. wire which is alternately positive and negative every cycle and a …….. wire at zero volts.

c) i) The oscilloscope trace in Figure 1 shows …….. complete cycles of an alternating potential difference.



ii) The peak potential difference is represented by the vertical height of a peak above the …….. .

iii) The …….. is the number of complete cycles per second.

2 a) Cables consist of two or three insulated wires made of …….. surrounded by an outer layer of …….. plastic material.

b) Sockets and plugs are made of …….. plastic materials which enclose the electrical connections.

c) In a three-pin plug or a three-core cable, the live wire is …….. in colour, the neutral wire is …….., and the earth wire is …….. . The …….. wire is used to earth the metal case of a mains appliance.

d) i) A fuse contains a thin wire that heats up and melts and cuts the current off if …….. current passes through it.

ii) A circuit breaker is an electromagnetic …….. that opens (i.e. ‘trips’) and cuts the current off if too much current passes through it.

3 a) The power supplied to a device is the energy transfer to it each second.

b) Electrical power supplied = …….. × ……..
(in watts) (in ……) (in ……)

c) i) An electric current is a flow of ……..

ii) When charge flows through a resistor, electrical energy is transferred as ……..

iii) Charge = …….. × …….. [Higher]
(in coulombs) (in ……) (in ……)

iv) Energy transferred = …….. × ……... [Higher]
(in joules) (in ……) (in ……)

Total ___/29

1 mark for each word/phrase in bold

Answers to summary questions

1 a) Mains electricity is an alternating current supply. Alternating current repeatedly **reverses** its direction.
b) A mains circuit has a **live** wire which is alternately positive and negative every cycle and a **neutral** wire at zero volts.
c) i) The oscilloscope trace in Figure 1 shows **two** complete cycles of an alternating potential difference.
ii) The peak potential difference is represented by the vertical height of a peak above the **middle**.
iii) The **frequency** is the number of complete cycles per second.

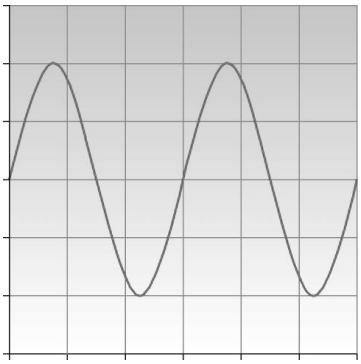


Figure 1

2 a) Cables consist of two or three insulated wires made of **copper** surrounded by an outer layer of **flexible** plastic material.
b) Sockets and plugs are made of **stiff** plastic materials which enclose the electrical connections.
c) In a three-pin plug or a three-core cable, the live wire is **brown** in colour, the neutral wire is **blue**, and the earth wire is **yellow/green**. The **earth** wire is used to earth the metal case of a mains appliance
d) i) A fuse contains a thin wire that heats up and melts and cuts the current off if **too much** current passes through it.
ii) A circuit breaker is an electromagnetic **switch** that opens (i.e. 'trips') and cuts the current off if too much current passes through it.

3 a) The power supplied to a device is the energy transfer to it each second.
b) Electrical power supplied = **current** × **potential difference.**
(in watts) (in **amperes**) (in **volts**)
c) i) An electric current is a flow of **charge**.
ii) When charge flows through a resistor, electrical energy is transferred as **heat**.
iii) Charge = **current** × **time**
(in coulombs) (in **amperes**) (in **seconds**)
iv) Energy transferred = **potential difference** × **charge flow**
(in joules) (in **volts**) (in **coulombs**)

Total = 29 marks

Name: **Class:**

Summary questions

Complete the sentences below.

1 a) i) An alpha particle consists of ……. protons and ……. neutrons.

ii) An alpha particle is emitted by an unstable nucleus that has ……. protons and neutrons. The nucleus ……. 2 protons and 2 neutrons when the alpha particle is emitted.

b) A beta particle is a fast-moving …….. . A beta particle is emitted from an unstable nucleus when a ……. in the nucleus changes to a …….. . The beta particle is ……. in this change and is instantly emitted.

2 a) Atoms of the same element each have the same number of ……. . The number of protons in a nucleus is denoted by the symbol …….. .

b) Isotopes are atoms of the same element with different numbers of …….. .

i) The number of protons and neutrons in a nucleus is called its …….. and is denoted by the symbol ……. .

ii) The number of protons in a nucleus is called the …….. or the atomic number and is denoted by the symbol ……. .

iii) The symbol for an isotope of an element X is $^{\cdots\cdots}_{\cdots\cdots}X$.

3 a) Alpha particles in a beam are sometimes scattered through ……. angles when they are directed at a thin metal foil.

b) Measurements from alpha-scattering experiments prove that an atom has a small ……. charged central nucleus where most of the ……. of the atom is located.

4 a) i) Nuclear fission occurs when a ……. collides with and ……. a uranium-235 nucleus or a plutonium-239 nucleus.

ii) When a nucleus undergoes fission, it releases ……. and two or three …….. .

b) A ……. reaction occurs when neutrons from fission go on to cause further fission.

c) In a nuclear reactor in which uranium-235 undergoes fission at a steady rate:

i) A ……. is used to slow down the neutrons so they produce further fission.

ii) ……. rods are used to absorb surplus neutrons.

iii) On average, one fission neutron per fission goes on to produce ……. fission.

Continued …

d) The used fuel from a nuclear reactor is ……. and radioactive when it is removed from the reactor. After it has cooled, it has to be stored in ……. containers for ……. years because it contains radioactive isotopes with …….. half-lives.

5 a) Nuclear fusion occurs when two ……. nuclei are forced close enough together so they form a single ……. nucleus.

b) ……. is released when two small nuclei are fused together.

c) A fusion reactor needs to be at a very ……. temperature before nuclear fusion can occur.

d) If the plasma (i.e. hot gases) in a fusion reactor goes out of control, nuclear fusion ……. .

Total ___/38

1 mark for each word/phrase in bold

Answers to summary questions

1 a) i) An alpha particle consists of **2** protons and **2** neutrons.
ii) An alpha particle is emitted by an unstable nucleus that has **too many** protons and neutrons. The nucleus **loses** 2 protons and 2 neutrons when the alpha particle is emitted.
b) A beta particle is a fast-moving **electron**. A beta particle is emitted from an unstable nucleus when a **neutron** in the nucleus changes to a **proton**. The beta particle is **created** in this change and is instantly emitted.

2 a) Atoms of the same element each have the same number of **protons**. The number of protons in a nucleus is denoted by the symbol **Z.**
b) Isotopes are atoms of the same element with different numbers of **neutrons**.
i) The number of protons and neutrons in a nucleus is called its **mass number** and is denoted by the symbol **A**.
ii) The number of protons in a nucleus is called the **proton number** or the atomic number and is denoted by the symbol **Z**.
iii) The symbol for an isotope of an element X is ${}^{A}_{Z}X$.

3 a) Alpha particles in a beam are sometimes scattered through **large** angles when they are directed at a thin metal foil.
b) Measurements from alpha-scattering experiments prove that an atom has a small **positively** charged central nucleus where most of the **mass** of the atom is located.

4 a) i) Nuclear fission occurs when a **neutron** collides with and **splits** a uranium-235 nucleus or a plutonium-239 nucleus.
ii) When a nucleus undergoes fission, it releases **energy** and two or three **neutrons**.
b) A **chain** reaction occurs when neutrons from fission go on to cause further fission.
c) In a nuclear reactor in which uranium-235 undergoes fission at a steady rate:
i) A **moderator** is used to slow down the neutrons so they produce further fission.
ii) **Control** rods are used to absorb surplus neutrons.
iii) On average, one fission neutron per fission goes on to produce **further** fission.
d) The used fuel from a nuclear reactor is **hot** and radioactive when it is removed from the reactor. After it has cooled, it has to be stored in **sealed** containers for **many** years because it contains radioactive isotopes with **very long** half-lives.

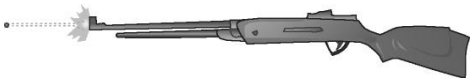
5 a) Nuclear fusion occurs when two **small** nuclei are forced close enough together so they form a single **larger** nucleus.
b) **Energy** is released when two small nuclei are fused together.
c) A fusion reactor needs to be at a very **high** temperature before nuclear fusion can occur.
d) If the plasma (i.e. hot gases) in a fusion reactor goes out of control, nuclear fusion **stops**.

Total =38 marks

Name: **Class:**

Additional physics revision

1 When an air-rifle is fired a small explosion takes place which pushes the pellet forwards and the air-rifle backwards.



(a) The mass of an air-rifle is 2 kg. The mass of the pellet is 0.0005 kg and its speed as it leaves the rifle is 100 m/s. Calculate the speed with which the air-rifle moves backwards.

.....

.....

..... *(3 marks)*

(b) The picture shows a batsman hitting a cricket ball.

The batsman 'follows through' when hitting the ball, so the force is applied to the ball for a longer time. Why does he do this?

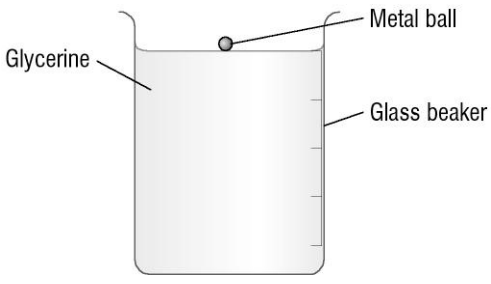
.....

.....

..... *(3 marks)*

[Higher]

2 A student is investigating terminal velocity. She drops a metal ball into a tall beaker containing glycerine.



Continued …

Initially the metal ball accelerates because of the force of gravity. Eventually the resultant force on the ball bearing becomes zero.

(a) Why does the resultant force become zero?

.....

.....

..... *(3 marks)*

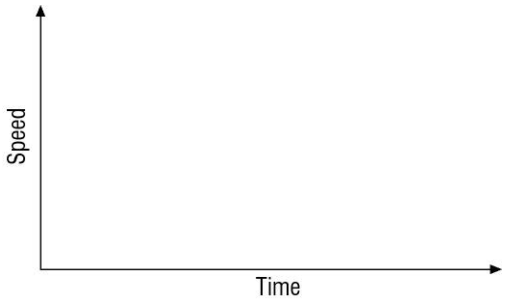
The student watches the ball slowly moving through the glycerine. As it does, she times how long it takes to get to each mark on the beaker.

(b) Describe what precautions she should take to make her results as accurate as possible.

.....

..... *(2 marks)*

(c) Using the axes below, sketch the line you would expect on the graph of speed of ball against time. *(3 marks)*



3 At one time scientists believed in a 'plum pudding' model of the atom.

(a) What is meant by the 'plum pudding' model of the atom?

.....

..... *(2 marks)*

(b) Rutherford and Marsden carried out an experiment that led to this model being replaced by the nuclear model.

They fired alpha particles at thin gold foil. Some of the observations from their experiment are given on the next page.

For each observation write down the matching explanation.

One has been done for you.

Continued …

Observation	Explanation
Most of the particles go straight through the gold foil without being deflected.	
Some particles are deflected through small angles.	The nucleus is charged.
A few alpha particles are deflected back through angles greater than 90^{o}.	

(*3 marks*)

[Higher]

4 In a fitness centre people use machines containing pulleys to move 'weights'.

(a) Some of the 'weights' are marked '5 kg'.

This is incorrect physics. Explain why.

.....

..... *(2 marks)*

(b) Calculate the work done on a 30 N weight when one of the machines raises it 2 m. Give a unit with your answer.

.....

.....

.....

..... *(4 marks)*

(c) A running machine displays the speed a person would be travelling if they were running on the road.

Calculate the kinetic energy of a person of mass 70 kg running at a speed of 5 m/s.
Give a unit with your answer.

.....

.....

.....

..... *(4 marks)*

[Higher]

Teacher notes

Additional physics

1 (a) Total momentum before = total momentum after *(1 mark)*
0 = 2 kg × v m/s + 0.0005 kg × 100 m/s *(1 mark)*
0 = 2 v kg m/s + 0.05 kg m/s
v = –0.05/2 m/s
v = –0.025 m/s *(sign not essential for the mark)* *(1 mark)*

(b) Change in momentum = force × time taken for the change. *(1 mark)*
If the force is applied for a longer time the gain in momentum is greater *(1 mark)*
so the velocity of the ball is greater. *(1 mark)*
[**HT** only]

2 (a) There is a drag force acting upwards on the ball. *(1 mark)*
The drag force increases as the speed increases. *(1 mark)*
Eventually drag force is equal to the weight (resultant force = zero). *(1 mark)*

(b) e.g. Eye at level of the ball.
Take time as lower surface of the ball passes the mark each time
Repeat the test. *(2 marks)*

(c) Straight line, showing initial acceleration. *(1 mark)*
Line curves. *(1 mark)*
Horizontal line to show terminal velocity. *(1 mark)*

3 (a) Negative electrons *(1 mark)*
stuck into a lump of positive matter. *(1 mark)*

(b) First explanation: Most of the atom is empty space. *(1 mark)*
Second explanation: The nucleus has a positive charge *(1 mark)*
and a large mass. *(1 mark)*
[**HT** only]

4 (a) 5 kg is a mass. *(1 mark)*
Weight is measured in newtons. *(1 mark)*

(b) Work done = force × distance moved in the direction of the force *(1 mark)*
Work done = 30 N × 2 m *(1 mark)*
Work done = 60 *(1 mark)*
Units of Nm or joules *(1 mark)*

(c) kinetic energy = ½ × mass × velocity^2 *(1 mark)*
kinetic energy = ½ × 70 kg × (5 m/s)^2 *(1 mark)*
kinetic energy = 875 J *(2 marks)*
[**HT** only]