NAME_____

Hartismere School

GCSE to AS Physics

Bridging Questions

Summer 2022

Use your GCSE resources, the internet or a physics textbook to help answer these questions in preparation for your AS course in physics.

Good textbooks you could use are:

The course text: **A Level Physics A for OCR Student Book** AG. Bone, G Chadha, N. Saunders
ISBN 978 0 19 835218 1
OR
Advanced Physics, S. Adams and J Allday (2000 or newer edition)
ISBN 0 19 914680 2
OR
New **A-Level Physics for OCR A**: Year 1 & AS Student Book with Online Edition
ISBN 978 1 78294 790 5

ESSENTIAL PURCHASE:

CGP Revision Guide **New A-Level Physics: OCR A Year 1 & 2 Complete Revision & Practice**,
ISBN 978 1 78294 345 7

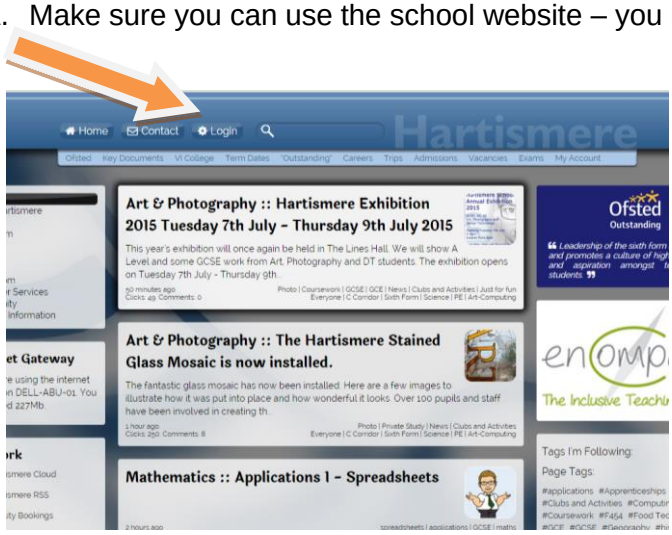
.The main course text will be available to students as an on-line text book free of charge. We also have copies of other textbooks students may borrow to assist with their independent study.

The CGP Revision guide book is vital – Copies will be available to order through school in September

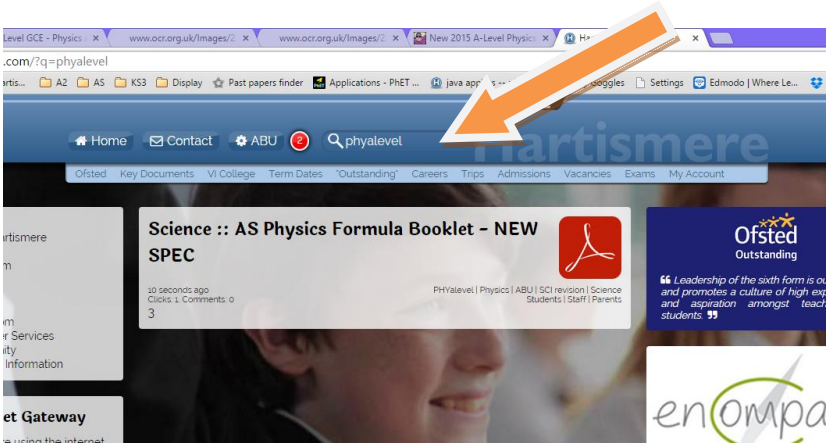
If you would like more questions feel free to browse the OCR website and look at past papers from the old specification. Looking forward to **seeing you in September.**

Preparation work

A. Make sure you can use the school website – you need to log in!



B. All your resources will be saved under the # 'PHYalevel' You type this into the search bar (once you have logged in) and all your resources will appear :-)



C. Go to the school website and download:

I. The formula book

II. The specification

III. The Maths skills handbook

IV. The Practical skills handbook

D. Get a folder sorted, a big ring binder is best with file dividers

E. Make sure you have a calculator that you can use, Casio is best and your GCSE one should still work and will be fine, just make sure you know how to use it.

F. Watch the videos available on the school website giving you help on using your calculator and explaining standard form / prefixes

G. Have a go at the questions in this booklet, they do get very hard towards the end and also some of the multiple choice ones are very challenging, try your best

Section A: Standard form and transposing formulae

1.) Make F the subject of P = F/A

2.) Make x the subject of F = kx

3.) Make v the subject of p = mv

4.) Make u the subject of v = u + at

5.) Make s the subject of $v^2 = u^2 + 2as$

6.) Make a the subject of $s = 0 + ½ at^2$

https://www.bbc.co.uk/bitesize/guides/zxsv97h/revision/1

https://www.youtube.com/watch?v=Pml4Z4BJibc

7.) Write the following in standard form to 3 significant figures. E.g. 236987325 = 2.37×10^8

i) 23569689253 =

ii) 12kW =

iii) 0.00002368 =

iv) 12.5nm =

v) 1236589 x 12358 x 0.123 =

vi) 1569µs =

vii) 10kW x 15GW =

viii) $0.236 \times 10^{-9} \times 3.62 \times 10^{-12}$ =

ix) 15mm x 15mm x 15mm (in m^2)

x) 3×10^8 / 15THz

Prefixes	Value	Standard form	Symbol
Tera	1 000 000 000 000	10^{12}	T
Giga	1 000 000 000	10^{9}	G
Mega	1 000 000	10^{6}	M
Kilo	1 000	10^{3}	k
deci	0.1	10^{-1}	d
centi	0.01	10^{-2}	c
milli	0.001	10^{-3}	m
micro	0.000 001	10^{-6}	µ
nano	0.000 000 001	10^{-9}	n
pico	0.000 000 000 001	10^{-12}	p

https://www.bipm.org/en/measurement-units/si-base-units

https://www.youtube.com/watch?v=jLRoseFxm30

2. For each of the following, give the full name of the SI or derived unit used.

(a) electric charge .....

(b) capacitance .....

(c) frequency .....

(d) stress .....

(e) gravitational field strength .....

(f) magnetic flux .....

(g) radioactive activity .....

[Total 7 marks]

mass	kg	kilogram	g gram okay
time	s	second	
plane angle	rad	radian	
solid angle	sr	steradian	
temperature	K	kelvin	
electric current	A	ampere	
amount of substance	mol	mole	
luminous intensity	cd	candela	

IAU-recognized derived units

frequency	Hz	hertz	s^{-1}
energy	J	joule	N m
power	W	watt	$J\ s^{-1}$
electric potential	V	volt	$J\ C^{-1}$
force	N	newton	$kg\ m\ s^{-2}$
pressure, stress	Pa	pascal	$N\ m^{-2}$
electric charge	C	coulomb	A s
electric resistance	Ohm	ohm	$V\ A^{-1}$
electric conductance	S	siemens	$A\ V^{-1}$
electric capacitance	F	farad	$C\ V^{-1}$
magnetic flux	Wb	weber	V s
magnetic flux density	T	tesla	$Wb\ m^{-2}$
inductance	H	henry	$Wb\ A^{-1}$
luminous flux	lm	lumen	cd sr
illuminance	lx	lux	$lm\ m^{-2}$

Section B: Multiple Choice

1. The dimensions of a cube are measured with vernier callipers.

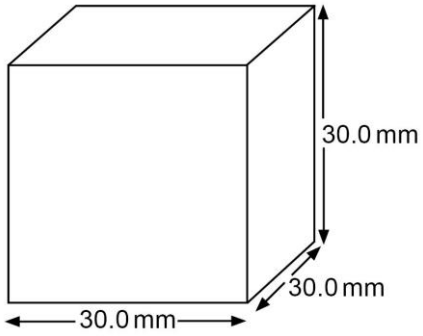
The measured length of each side is 30.0 mm. If the vernier callipers can be read with an uncertainty of +/- 0.1 mm. What is the approximate percentage uncertainty in the value of the volume?

A 4%

B 3%

C 0.3%

D 1%



https://www.youtube.com/watch?v=eJg8rb5n5a8

https://www.youtube.com/watch?v=SNRp92jIq9s

2. A current of 3.0 μA flows through a resistor in 1.5 minutes.

How much charge flows through the resistor in this time?

A 4.5×10^{-6} C

B 2.7×10^{-4} C

C 4.5×10^{-3} C

D 2.7×10^{-1} C

Your answer

https://www.hartismere.com/20499/ZOOOM5CWLYGAJ36023.pdf/h156-and-h556-data-formulae-and-relationships-booklet

3. Which group of electromagnetic waves is arranged in order of increasing frequency?

lowest frequency → highest frequency

A gamma rays, ultra-violet rays, radio waves

B microwaves, ultra-violet rays, X-rays

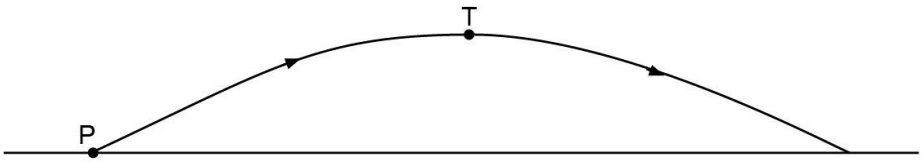
C radio waves, visible light, infra-red radiation

D Visible light, infra-red radiation, microwaves

Your answer ☐

https://www.youtube.com/watch?v=bjOGNVH3D4Y

4. In the absence of air resistance a stone is thrown from **P** and follows a parabolic path, as shown, in which the highest point reached is **T**.



The vertical component of acceleration of the stone, as it follows this path, is:

A zero at **T**

B greatest at **T**

C greatest at **P**

D The same at **P** as at **T**

Your answer ☐

https://www.savemyexams.co.uk/a-level/physics/cie/22/revision-notes/2-kinematics/2-1-equations-of-motion/2-1-9-projectile-motion/

https://www.youtube.com/watch?v=p30tWWEElxU

Section C Other past paper Qs

1) Explain the quantities

(i) gravitational potential energy

.....

.....

.....

[2]

(ii) kinetic energy

.....

.....

.....

[2]

(iii) power.

.....

.....

.....

[1]

[Total 5 marks]

2. (i) Define *velocity.*

.....

.....

[1]

(ii) Define *acceleration.*

.....

.....

[1]

[Total 2 marks]

3. Define

(i) the *moment* of a force

.....

.....

[2]

(ii) the *torque* of a couple.

.....

.....

[1]

[Total 3 marks]

4. Draw a line from each unit on the left-hand side to the correct equivalent unit on the right-hand side.

joule (J)	kg m s^{-2}
watt (W)	N m
newton (N)	J s^{-1}

Total 2 marks]

5. State *Hooke's law*.

.....

.....

[Total 1 mark]

6. Define the quantities

(i) *stress*

.....

[1]

(ii) *strain.*

.....

[1]

[Total 2 marks]

7. (a) Explain what is meant by a brittle material.

.....

.....

[1]

(b) Define the ultimate tensile strength of a material. Suggest why an engineer designing a suspension bridge should know the value of this quantity for all his materials.

.....

.....

[2]

[Total 3 marks]

8. State the principle of conservation of energy.

.....

.....

[Total 1 mark]

9. Define the *newton*.

.....

.....

[Total 1 mark]

10. (a) Define a *vector quantity*.

.....

.....

[1]

(b) Circle all the vector quantities in the list below.

acceleration speed time displacement weight

[1]

11. A skydiver jumps from a stationary hot-air balloon several kilometres above the ground.

(a) In terms of acceleration and forces, explain the motion of the skydiver

immediately after jumping .....

.....

.....

.....

.....

.....

at a time **before** terminal velocity is reached .....

.....

.....

.....

.....

.....

at terminal velocity. .....

.....

.....

.....

.....

.....

[6]

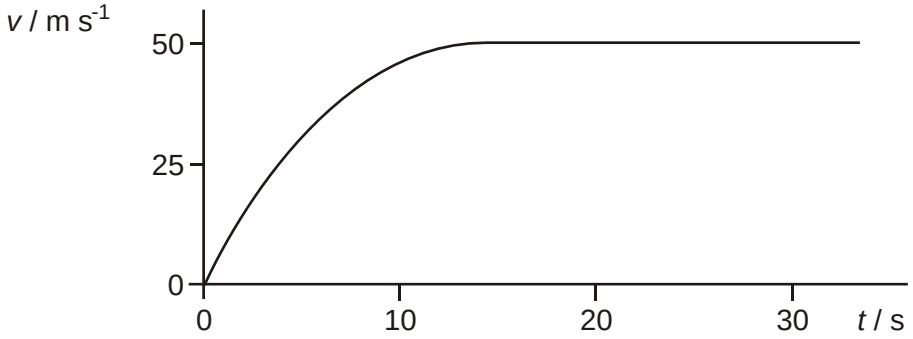
(b) In the final stage of the fall, the skydiver is falling through air at a constant speed. The skydiver's kinetic energy does not change even though there is a decrease in the gravitational potential energy. State what happens to this loss of gravitational potential energy.

.....

.....

[1]

(c) The figure below shows a sketch graph of the variation of the velocity *v* of the skydiver with time *t*.



Suggest the changes to the graph of the figure above, if any, for a more massive (heavier) skydiver of the same shape.

.....

.....

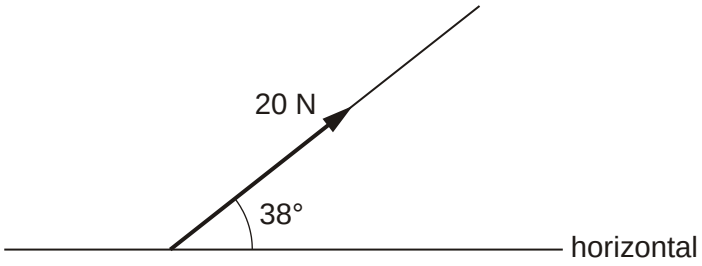
.....

.....

[2]

[Total 9 marks]

12. The figure below shows a 20 N force acting at an angle of 38° to the horizontal.



Determine the horizontal and vertical components of this force.

horizontal component = ... N

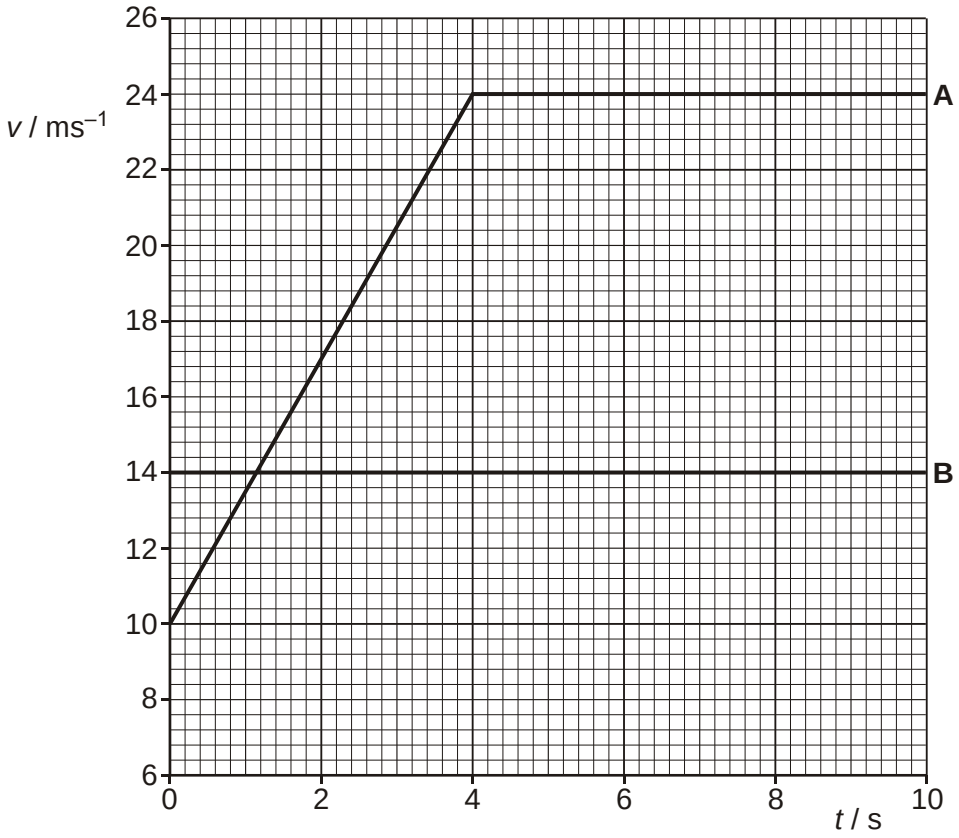
[1]

vertical component = ... N

[1]

[Total 2 marks]

13. The figure below shows graphs of velocity v against time t for two cars **A** and **B** travelling along a straight level road in the same direction.



At time t = 0, both cars are side-by-side.

(i) Describe the motion of car **A** from t = 0 to t = 10 s.

.....

.....

.....

[2]

(ii) Calculate the distance travelled by car **A** in the first 4.0 s.

distance = ... m

[2]

(iii) Use the figure above to find

1 the time at which both cars have the same velocity

time = ... s

[1]

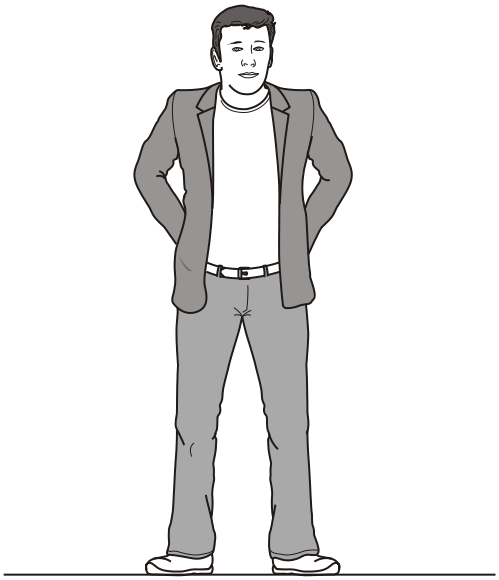
2 the time t at which car **A** overtakes car **B**.

t = ... s

[2]

[Total 7 marks]

14. This question is about estimating the pressure exerted by a person wearing shoes standing on a floor, see the figure below.



(i) Estimate the weight in newtons of a person.

weight = ... N

[1]

(ii) Estimate the total area of contact in square metres between the shoes of this person and the floor.

area = ... m^2

[1]

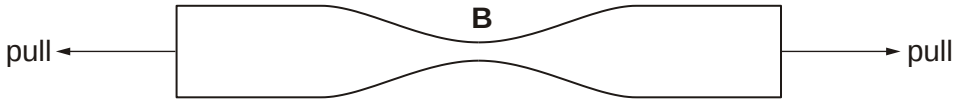
(iii) Hence estimate the pressure in pascals exerted by this person standing on the floor.

pressure = ... Pa

[1]

[Total 3 marks]

15. The figure below shows a length of tape under tension.



(i) Explain why the tape is most likely to break at point **B**.

.....

.....

[1]

(ii) Explain what is meant by the statement:

'the tape has gone beyond its elastic limit'.

.....

.....

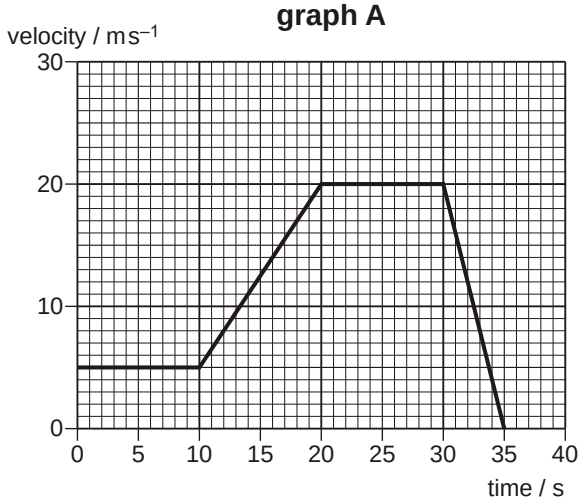
.....

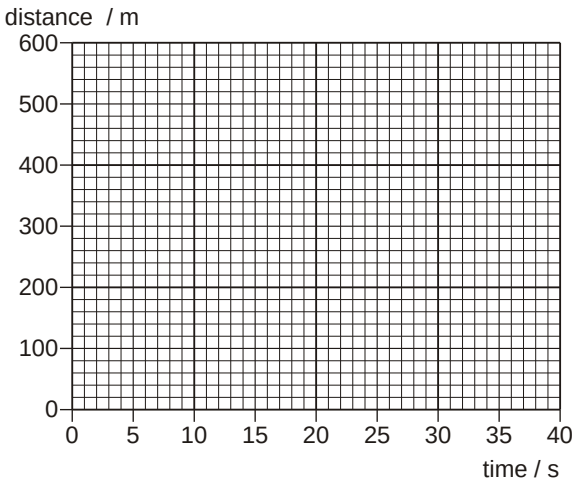
[1]

[Total 2 marks]

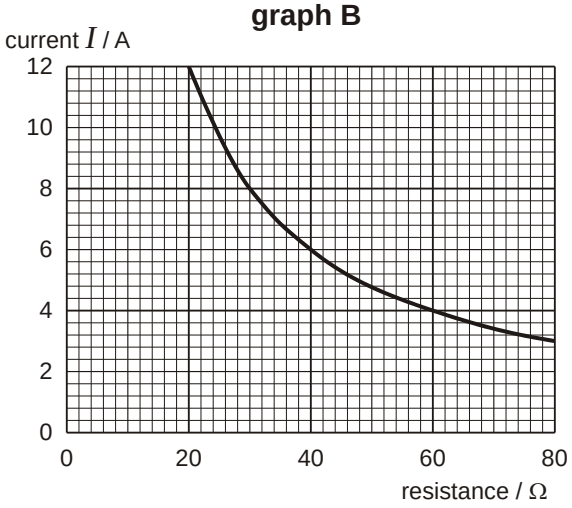
16. Data can be displayed in graphical form in many different ways. Sometimes it is necessary to change from one way of displaying data to another. Four graphs are drawn below.

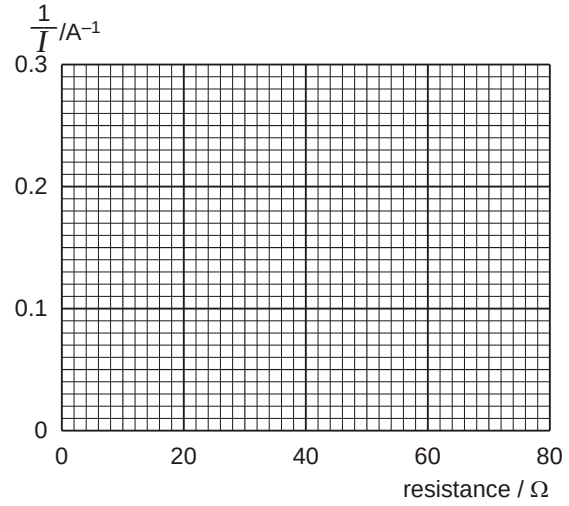
graph A



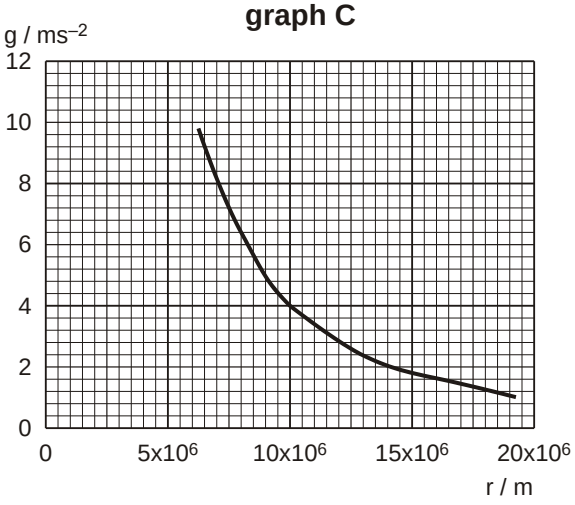


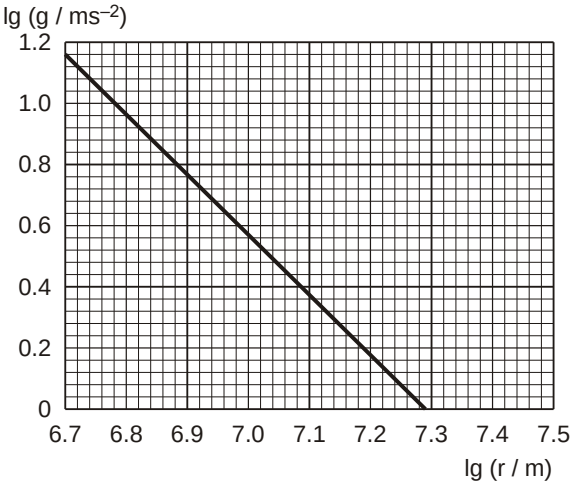
graph B





graph C





(a) (i) Calculate the total distance travelled from the velocity-time **graph A**.

distance = ... m

[3]

(ii) Using **graph A**, draw the corresponding distance-time graph.

[3]

(b) **Graph B** shows how the current I in a circuit varies with the total circuit resistance *R* when the e.m.f. of the supply is kept constant.

(i) Draw the corresponding graph of $1/I$ against *R*.

[2]

(ii) What is the e.m.f. of the supply?

e.m.f. = ... V

[1]

(iii) How is the gradient of the graph you have drawn related to your answer to (b)(ii)?

.....

.....

[1]

(c) **Graph C** shows how *g*, the acceleration due to gravity, varies with *r*, the distance from the centre of the Earth. A log-log graph showing the same data has been drawn on new axes.

(i) Calculate the gradient of the log-log graph.

gradient = ...

[2]

(ii) What can be deduced from the value of the gradient?

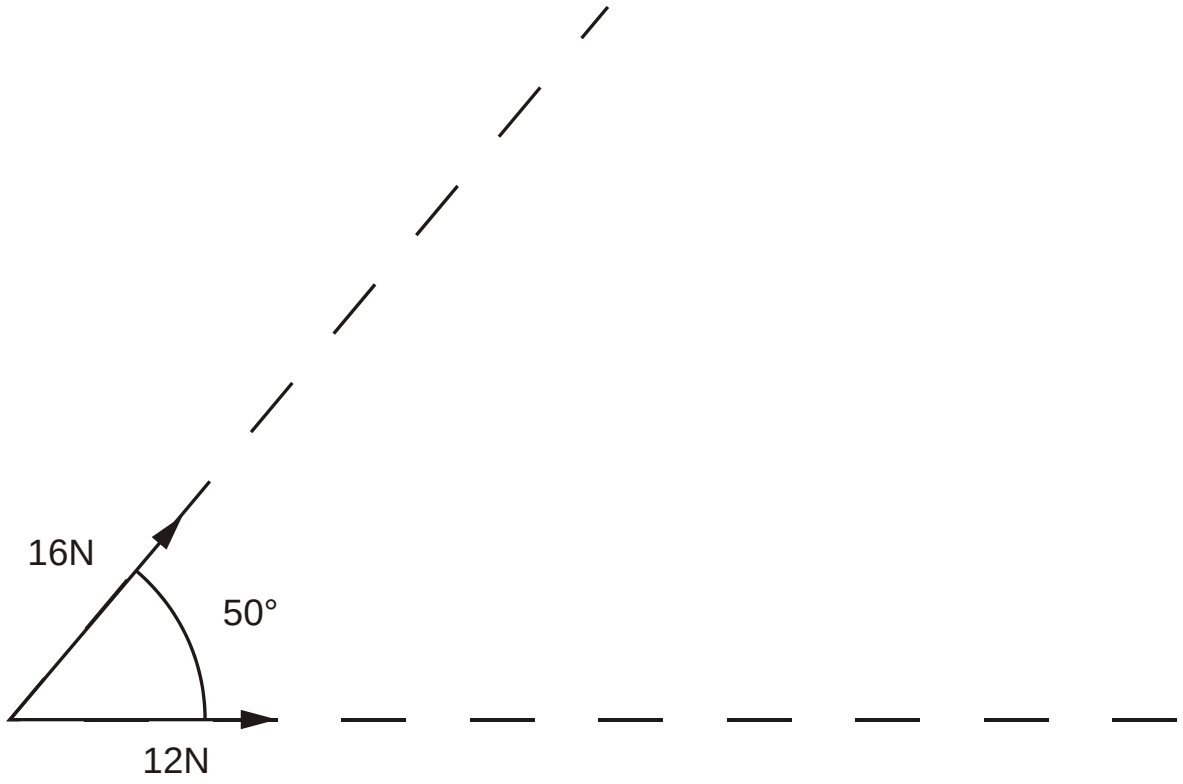
.....

.....

[2]

[Total 14 marks]

17. The figure below shows the direction of two forces of 16 N and 12 N acting at an angle of 50° to each other.



Using the figure, draw a scale vector diagram to determine the magnitude of the resultant of the two forces.

magnitude of resultant force ..... N

[Total 4 marks]

18. The following is adapted from an article about superconducting devices written by Archie M. Campbell for “Physics World”. Read the following paragraphs and answer the questions which follow.

The electrical resistance of a material suddenly vanishes when it becomes superconducting. This remarkable transition takes place at a critical temperature, which is within a few degrees of absolute zero for most superconducting materials. Certain materials have critical temperatures which are appreciably above absolute zero. Yttrium barium copper oxide (YBCO) has a critical temperature of 92 K and below this temperature it is superconducting. Such materials are extremely useful for electrical devices. For example, the very high currents that can be passed through superconducting materials can be used to generate large magnetic fields, such as those used in magnetic separation of charged particles or in making powerful electric motors.

A problem is that heat will enter into such a cold device. The rate at which work needs to be done to remove the heat leaking into the device increases as the operating temperature is lowered. At 77 K heat leaking in at the rate of 1 W requires 30 W of power to be supplied to the cooling mechanism to maintain a constant temperature. At 4.2 K the power supplied needs to increase to 300 W for each watt leaking in.

(a) State the resistance of a superconducting material below the critical temperature.

Ω .....

[1]

(b) Calculate the power required by the cooling mechanism at 4.2 K if heat is leaking into a superconducting device at a rate of 20W.

power = ... W

[1]

(c) Suggest why a superconducting device using YBCO will be run at a temperature of, say, 77 K when its critical temperature is 92 K.

.....

.....

.....

[2]

(d) A large electromagnet is made out of superconducting wire of square cross-section having area 1.0 mm^2. It is a circular coil containing 3200 turns of average radius 0.30 m.
A cut-away diagram is shown in Fig. 1. The wire, when superconducting, has current density through it of 2.0×10^8 amperes per square metre (A m^{-2}) of cross-section.

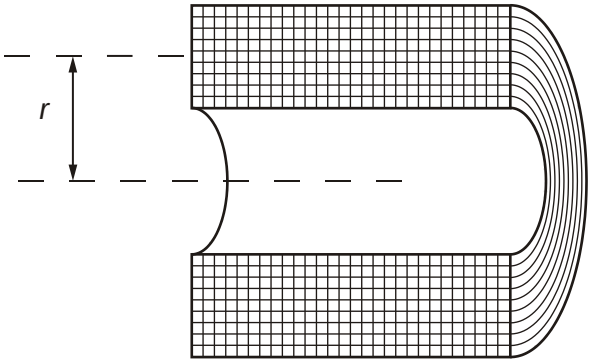


Fig. 1

(i) Show that the current in the wire is 200 A.

[2]

(ii) The magnetic flux density B caused by such a coil can be estimated using the equation

$$B = \frac{\mu_0 IN}{2r}$$

where I is the current, N the number of turns, r the average radius of the coil and μ_0 is a constant equal to 1.26×10^{-6} T m A^{-1}.
Calculate the resulting magnetic flux density.

magnetic flux density = ... T

[2]

(e) Isotopes of an element can be separated by first ionising them and then firing them into a magnetic field. For example, if singly ionised atoms of U-235 and U-238 are fired into a magnetic field they are deflected into circular paths of different radii.

(i) State the equation for the force F acting on a charge Q moving with velocity v at right angles to a magnetic field of flux density B.

.....

[1]

(ii) Calculate the radius of the circular path of a singly-charged U-235^+ ion when it is fired with a velocity of 8.3×10^5 m s^{-1} at right angles into the magnetic field caused by the superconducting coil in (d)(ii). Assume that the charge on this ion is $+1.60 \times 10^{-19}$ C.

radius of path = ... m

[4]

(iii) A beam containing singly ionised U-235^{+} and U-238^{+} ions, all travelling at the same speed, enters a region of uniform magnetic field. Sketch the paths of these ions in the region of the magnetic field in Fig. 2. Label the diagram clearly. No calculation is required.

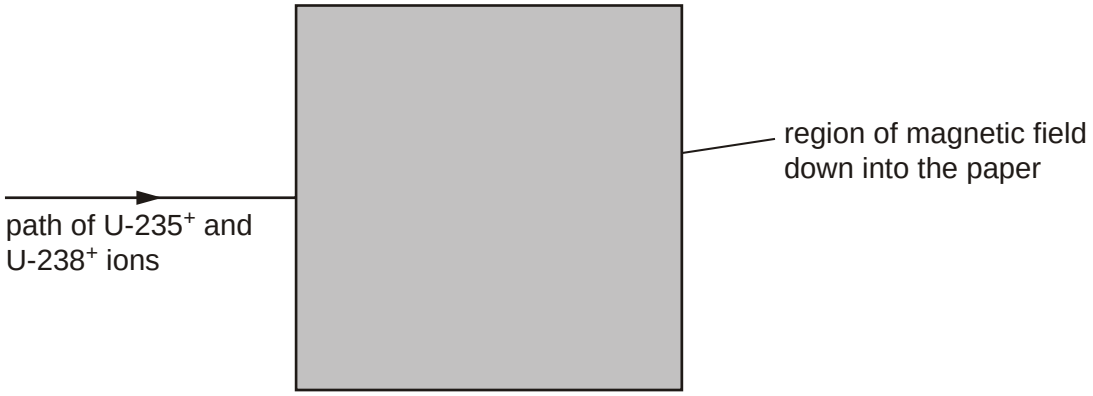


Fig. 2

[3]

[Total 16 marks]