

Summer 2018
A-level Physics
Study Task

All of the tasks in this booklet are based on areas you have covered at GCSE or in Year 12.

Use your textbook to help you complete the tasks.



1. Foundations of Physics Part 1 – Physical quantities and their units

1. What is the SI unit for current?

2. What is the SI unit for time?

3. Write the unit for force in SI units

4. What is the unit prefix for 10^9

5. Convert $9\mu\text{m}$ into metres

6. Convert 3560cg into kg

7. Convert 2.5mm^2 into m^2

8. Convert 562cm^3 into m^3

9. Convert $2.6 \times 10^{-3}\text{m}^2$ into cm^2

10. Convert 3 eV into joules

1) What is the approximate diameter of a plastic cup?

- a) 0.0005 m b) 0.005 m c) 0.05 m d) 0.5 m

2) Estimate how many times the word 'estimate' appears in the physics syllabus.

- a) 10^0 b) 10^1 c) 10^2 d) 10^3

3) Which measurement is closest to 1×10^{-1} m?

- a. diameter of an atom
- b. height of a giraffe
- c. length of a hand
- d. width of a human hair

4) Calculate $3.0 \times 10^5 \times 5.0 \times 10^2$

5) Calculate $2.14 \times 10^{-3} / 1.59 \times 10^{-3}$

6) In SI units estimate the average lifetime of a human

7) In SI units estimate the height of a 5 story building

8) If you could drive a car to the ISS estimate how long would it take

9) If 1 million £10 notes were stacked on top of each other, estimate how high they'd reach.

10) Identify an everyday object that has an area of 10 cm^2

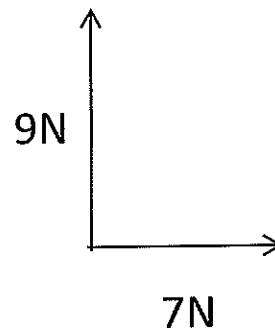
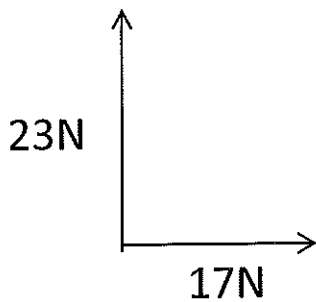
Foundations of Physics Part 2 – Making Measurements and Analysing Data

A student measured the length of a wire, with a ruler, as 2.7 cm.

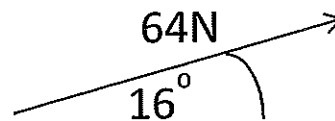
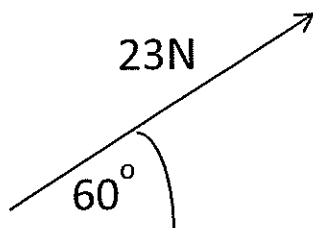
1. What is the absolute uncertainty?
2. What is the percentage uncertainty?
3. What is the fractional uncertainty?
4. What does it mean if a result is accurate?

Foundations of Physics Part 3 – Nature of Quantities

- 1.) Name 3 Scalar Quantities
- 2.) Name 3 Vector Quantities
- 3.) Resolve these forces to find the resultant force;



- 4.) Calculate the horizontal and vertical components of these forces.



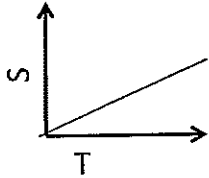
- 5.) Define the difference between Scalar and Vector quantities

Forces and Motion Part 1

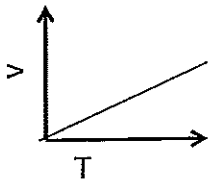
Motion

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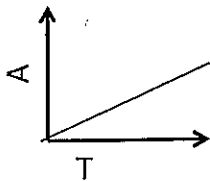
QuestionIT



1.) What quantity is represented by the;
Gradient –
Area under the graph



2.) What quantity is represented by the;
Gradient –
Area under the graph



3.) What quantity is represented by the;
Gradient –
Area under the graph

4) What are the units of u , v , a , s , t ?

5) An arrow hits the ground after being fired horizontally at a speed of 25ms^{-1} from the top of a tower 20m above the ground. Calculate;

How long the arrow takes to fall to the ground.

The distance travelled horizontally by the arrow.

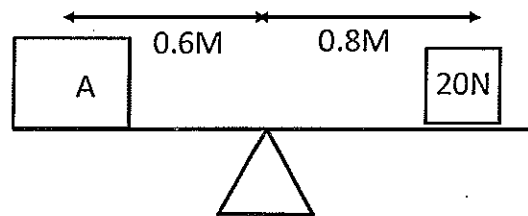
Forces and Motion Part 2

Forces in action

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Question 17

- 1) A box is resting on a slope inclined at 20 degrees to the horizontal. Sketch a free body force diagram labelling all the forces acting on the box.
- 2) State the principle of moments.
- 3) Calculate the weight of box A assuming the see-saw is balanced:



- 4) State the unit of a moment.
- 5) Define the centre of mass of an object.
- 6) State the unit of density.
- 7) A sphere has a radius of 10mm and a mass of 50g. Calculate its average density.
- 8) A floating boat has a mass of 1000kg. How much water will the boat displace? (density of water = 1000kg/m^3 ?)

Forces and Motion

Part 3

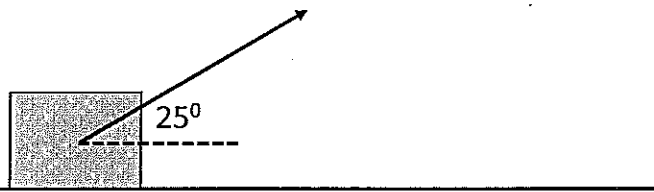
Work, Energy and

Power

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QuestionIT

- 1) What are the units of work done?
- 2) Calculate the work done if the box below is dragged along the floor for a distance of 20m.



- 3) What happens to the mechanical energy supplied when doing work on the box?
- 4) State the difference between an elastic and inelastic collision.
- 5) Calculate the gravitational potential energy of a 2kg rock held at the top of a 250m tower. (Assume $g = 10\text{N/kg}$)
- 6) Using the principle of energy conservation, how much kinetic energy will the rock have just before it hits the floor if it is dropped. (You may assume air resistance is negligible)
- 7) Calculate the maximum speed reached by the rock in Q5/6.
- 8) In reality will this speed be faster or slower? Explain your answer.

Forces and Motion

Part 4

Materials

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Question 1

- 1.) Define 'brittle'.

- 2.) For a force-extension graph, what quantity is represented by;
 Gradient?
 Area under the curve?

- 3.) Define 'ductile'.

- 4.) Define 'Young modulus'.

- 5.) How is the spring constant affected by;
 Springs being added in series?
 Springs being added in parallel?

- 6.) Sketch a stress/strain graph for a ductile material.

- 7.) Sketch a stress/strain graph for a brittle material.

8.) Calculate the tensile stress in a wire of diameter of 0.25mm when the tension in the wire is 50N

9.) A vertical steel wire of length 2.5m and diameter 0.35mm supports weight of 90N. Calculate the extension of the wire.

Young modulus of steel = 2.1×10^{11} Pa

10.) A regular brick of dimensions 5.0cm x 8.0cm x 20.0cm has a mass of 2.5 kg. Calculate its density.

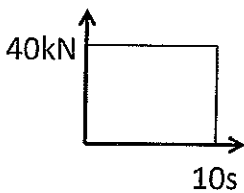
Forces and Motion

Part 5

Newton's Laws and Momentum

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QuestionIT

- 1) What is Newton's first law of motion?
- 2) What is Newton's second law of motion?
- 3) Define 'impulse'.
- 4) How do crumple zones and seat belts increase the safety for passengers?
- 5) Calculate the momentum of a 20g bullet travelling at 300m/s
- 6) Calculate the impulse for the collision shown on the force time graph:

- 7) Calculate the change in momentum.
- 8) Calculate the final velocity if the object in question '6' was initially at rest and had a mass of 200g.

Electrons, Waves

And Photons

Part 1

1. Charge and Current
2. Energy, Power and Resistance

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QuestionIT

- 1) Define current.
- 2) State Kirchhoff's 2nd Law.
- 3) Which type of material has the lowest number density of charge carriers?
- 4) Calculate the average drift velocity of electrons flowing as a 1A current in wire of cross sectional area $8 \times 10^{-7} \text{m}^2$, that has a number density of 1×10^{28}
- 5) How are potential difference and current measured in a circuit?
- 6) Define potential difference.
- 7) What are the characteristics of a Ohmic conductor?
- 8.) What are the characteristics of a semi-conductor diode?
- 9.) What are the characteristics of a filament bulb?
- 10.) What is the SI equivalent to a "Unit" of electrical energy?

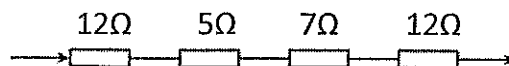
Electrons, Waves
And Photons
Part 2

Electrical Circuits

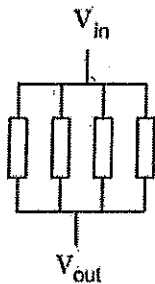


QuestionIT

1.) What is the total resistance of the circuit below?



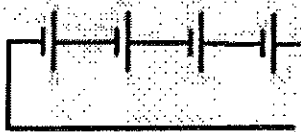
2.) What is the total resistance of the circuit below?



Each resistor has a resistance of 14Ω

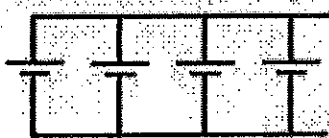
3.) What is the total pd given out by this cell arrangement;

2V 2V 2V 2V



4.) What is the total pd given out by this cell arrangement;

2V 2V 2V 2V



5.) Define 'electromotive force'.

6.) Define 'resistivity'.

7) What is a potential divider?

8) What is internal resistance?

9) A battery of emf 12V and internal resistance of 1.5Ω is connected to a 4.5Ω resistor.

Calculate;

a) Total resistance of the circuit

b) Current through the battery

c) The lost volts

d) pd across the terminal cells

10) A potential divider consists of 8.0Ω resistor in series with a 4.0Ω resistor and a 6.0V cell of negligible internal resistance.

a) Calculate the current

b) Calculate the p.d. across each resistor.

11) Why is internal resistance more significant as a larger current is drawn?

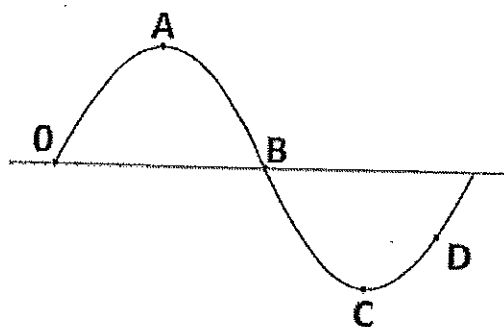
Waves

Part 3

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Waves part 3 - Question 1

1. What do waves transfer?
 2. Give an example of a mechanical wave.
 3. What type of waves undergo polarisation?
 4. Name a longitudinal wave.
 5. If a wave has a frequency of 5 Hz , what is its time period?
- What is the phase difference between
6. 0-A?
 7. 0-B?
 8. 0-C?
 9. 0-D?
10. What is 360° in radians?



Waves

Part 4

Refraction

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Waves Part 4 – Question 1

1. What is the refractive index of air?
2. What happens if light is incident on a surface at the critical angle?
3. What happens if light is incident on a surface at an angle larger than the critical angle?
4. State a use of optical fibres.
5. State an advantage of optical fibres over copper wires.
6. How can multipath dispersion be reduced?
7. What is another type of dispersion that occurs in optical fibres?
8. What surrounds the core of an optical fibre?
9. Why doesn't total internal reflection occur when light travels from air into glass?
10. What happens to the wavelength of light when it enters a more optically dense substance?

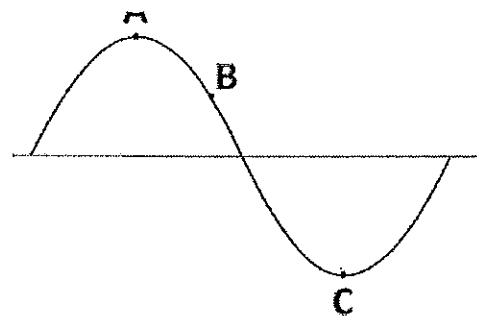
Electrons, Waves
And Photons
Part 3

Waves

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Waves Part 3 - Question 1

1. What is the difference between a stationary and progressive wave?
2. What properties do 2 progressive waves need in order to form a stationary wave?
3. What is a node?
4. What is an antinode?
5. Draw the shape formed by a wave vibrating in the second harmonic.
6. What is the phase difference between A and B?
7. What is the phase difference between A and C?
8. A stationary wave has 5 nodes in 80cm. What is the wavelength?
9. What is constructive interference?
10. What is destructive interference?



11. What does it mean if 2 waves are coherent?

12. What is meant by path difference?

In Young's double slit experiment:

13. Why is a bright fringe formed?

14. Why is a dark fringe formed?

15. How can you ensure the fringe measurement is accurate?

16. How does the diffraction pattern produced with a single slit differ from that produced with a double slit?

17. In single slit diffraction how can the width of the central beam be increased?

18. State a use of a diffraction grating.

19. If there are 3 orders visible, how many bright spots are there in total?

20. Describe the pattern produced when white light is directed through a single slit.

Electrons, Waves

And Photons

Part 4

Quantum Physics



EM Radiation and Quantum Phenomena Part 1– Question 1

1. In the photoelectric effect why does a threshold frequency exist?
 2. Explain why the kinetic energy of photoelectrons emitted from a surface vary up to a maximum.
 3. How can you increase the maximum kinetic energy of a photoelectron?
 4. Why are no electrons emitted when red light is shone on a metal plate?
 5. Describe the effect of increasing the intensity of red light in question 4.
- When violet light is shone on a metal electrons are released.
6. What effect will increasing the intensity have?
 7. What effect will decreasing the frequency have?
 8. Convert 3eV in Joules
 9. Convert 2.7×10^{-4} J into eV
 10. What is the lowest energy state an electron can be in known as?