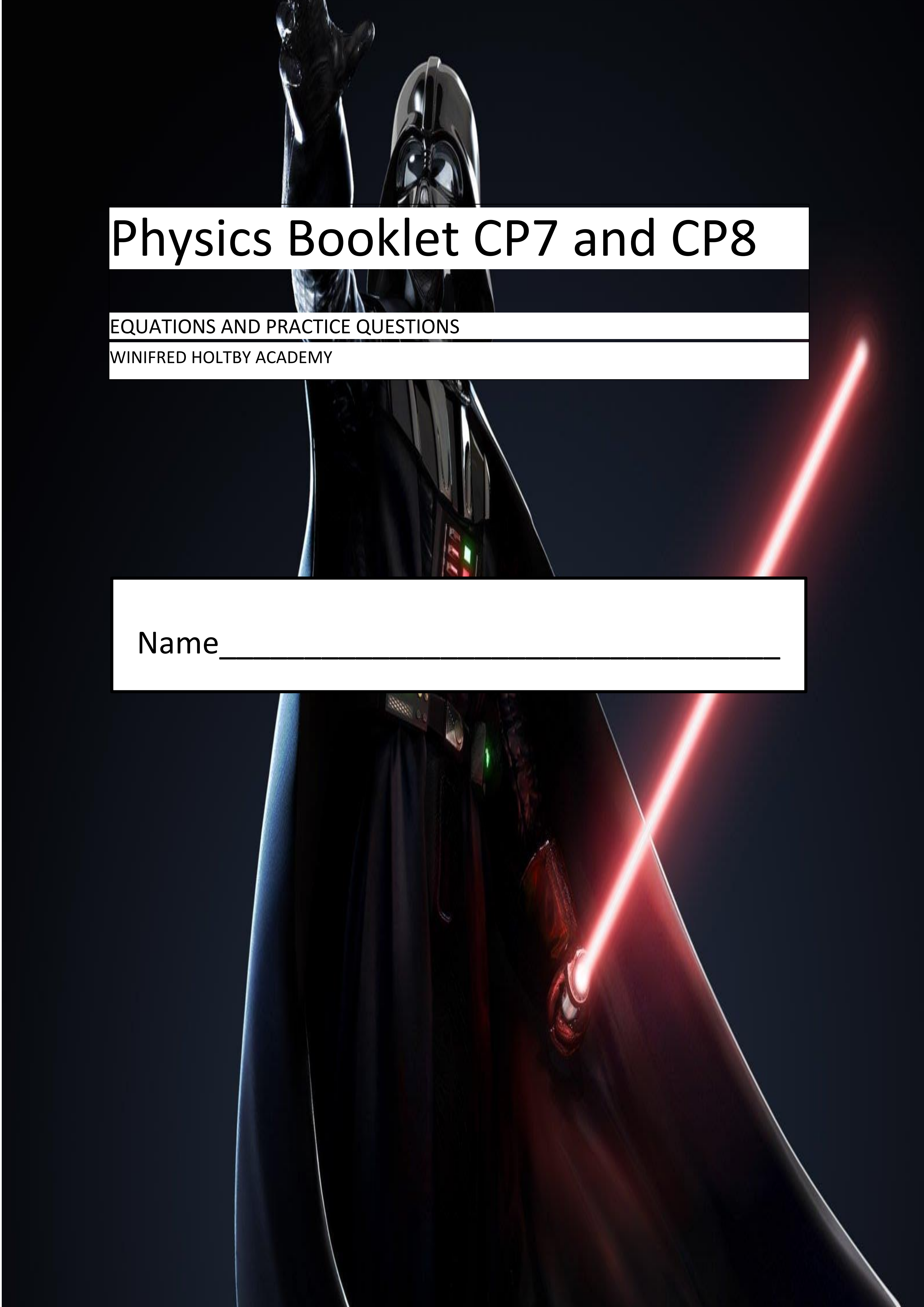


Physics Booklet CP7 and CP8

EQUATIONS AND PRACTICE QUESTIONS

WINIFRED HOLTBY ACADEMY

Name_________________________________

Write as many of the equations as you can remember in this box. Correct them in green pen using the equations sheet on the back.

CP7a.2

1 The words and symbols in the box below are parts of the equations used to calculate **work done** and **power**.

Draw a table with the headings below followed by six empty rows.

Symbol	Description	Unit symbol	Work done or power equation?

Complete your table using the symbols and words from the box. You can use the words and symbols more than once.

d	distance moved in the direction of the force		*E*	*F*	force	J
m	N	*P*	power	s	*t*	time taken	W	work done

2 Jenna pushed a box along the floor using a force of 30 N. She moved the box 3 m in 10 seconds.

a Calculate the work done when Jenna pushed the box.

b Calculate the power Jenna used.

This equation shows how much **energy** is stored when an object is moved into a higher position.

change in gravitational potential energy (ΔGPE) = mass × gravitational field strength × change in vertical height

Mass × gravitational field strength is the weight of the object. So this equation is similar to the equation for work done.

3 In the equation for ΔGPE, which term is the equivalent of:

a work done **b** force **c** distance moved?

4 Jenna lifts the box in question **2** onto a shelf 1 m above the floor. She uses a force of 50 N. The mass of the box is 5 kg.

a Calculate the work done as Jenna lifts the box.

b Calculate the change in gravitational potential energy when Jenna puts the box onto the shelf. Use *g* = 10 N/kg.

5 A crane lifts a mass of 500 kg to a height of 20 m.

a Calculate the change in ΔGPE as the crane lifts the mass.

b The crane transfers 110 000 J of energy as it lifts the mass. Explain how much of the energy transferred by the crane is wasted energy.

c Describe what happens to the wasted energy and explain why this energy is not useful.

d Calculate the efficiency of the crane.

$$\text{efficiency} = \frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$$

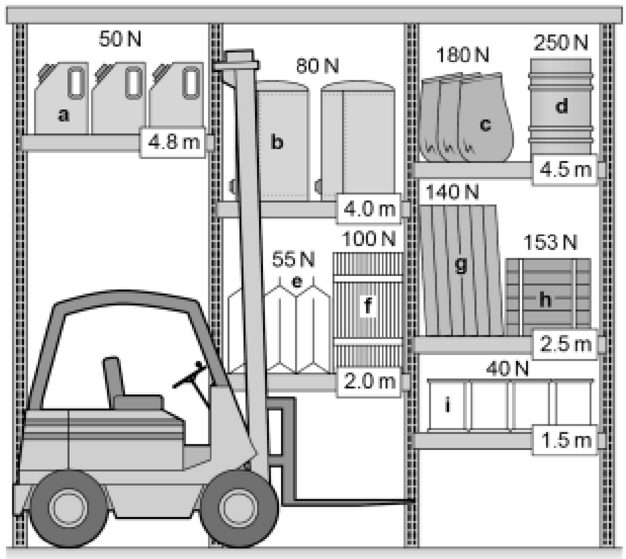
Answer the questions using the F.R.S.A.U format and a calculator.

CP7a.3

You will be expected to recall the equation linking **work done**, force and distance in your examination, and also the one linking **power**, work done and time. You will need to choose the correct equation to answer the question, and you should also be able to change the subject of the equations and to use the correct units.

1 The drawing shows some goods in a warehouse. The fork-lift truck must provide a force equal to the weight of each item to lift it.

Calculate the work done when each item (labelled **a–i**) is lifted onto the shelf.



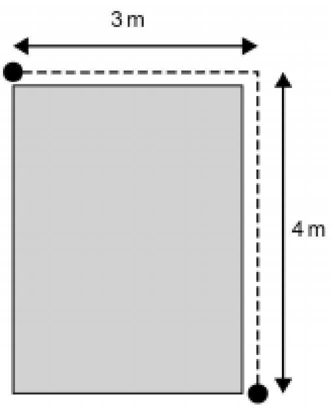
2 The table shows the work done (**energy** transferred) by some forces as they move objects.

Use the equation relating work done, force and distance to calculate the missing numbers in the table.

	Work done (J)	Force (N)	Distance moved (m)
a	10 000		20
b	10		0.5
c	80	40	
d	350	70	
e	5 000 000		500
f	0.16	0.2	

3 A gardener pushes a wheelbarrow around the edges of a lawn, as shown below. When she has finished, she is 5 m from her starting point.

She has to pull upwards with a force of 300 N to lift the legs of the wheelbarrow off the ground. She pushes the wheelbarrow along the ground with a force of 100 N.



Calculate how much work the gardener does in pushing the wheelbarrow around the lawn. (*Hint:* think carefully about which force and which distance you need to use in your answer.)

Write as many of the equations as you can remember in this box. Correct them in green pen using the equations sheet on the back.

CP7a.3

4 The table shows the power, time taken and work done to move different objects.

Use the equation relating work done, power and time to calculate the missing values.

	Power (W)	Work done (J)	Time taken (s)
a		90 000	30
b	20		5
c		100	2
d	700	245	
e	25		75
f	50 000	500 000	
g		450	3
h	0.5	5	

5 The diagram below shows a ramp leading to a platform 0.8 m high. The suitcase has a weight of 500 N.

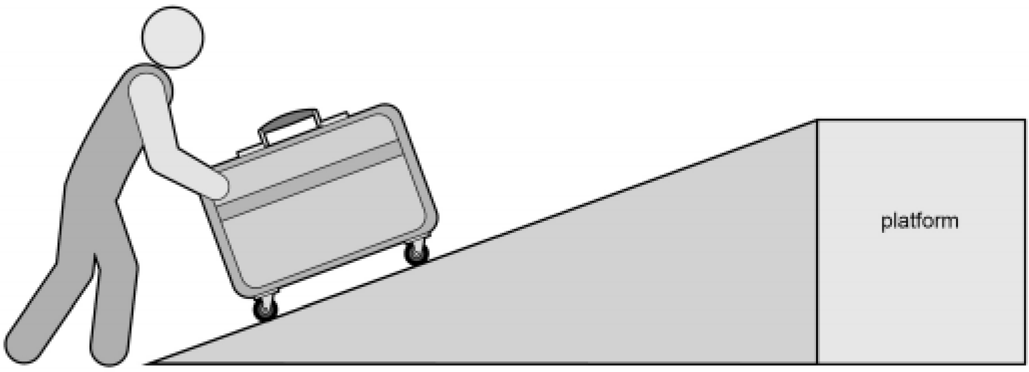
a Calculate the work done if the suitcase is lifted directly upwards to the top of the 0.8 m high platform.

b It takes five seconds to lift the suitcase. Calculate the power used.

c The ramp is 2.5 m long. It takes a force of 160 N to push the suitcase up the ramp to the top of the platform.

Calculate the work done in pushing the suitcase up the ramp.

d It takes eight seconds to push the suitcase up the ramp. Calculate the power used.



6 A person has a weight of 750 N. She needs to go to the top floor of a skyscraper. The top floor is 200 m above the ground.

a Calculate the work that must be done for the person to go from the ground to the top floor.

b It takes a person 20 minutes to climb the stairs to reach the top floor. Calculate the person's power.

c The lifts in the building have a power of 5 kW. Calculate the time it takes the person to reach the top floor using a lift.

Answer the questions using the F.R.S.A.U format and a calculator.

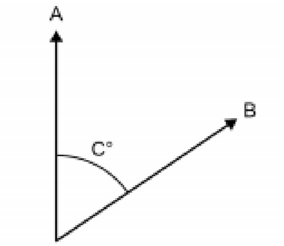
CP8b.3

1 The diagram shows two forces at an angle. Draw **scale diagrams** to work out the size and direction of the **resultant force** if:

a A = 50 N, B = 25 N, C = 90°

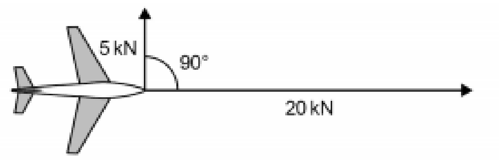
b A = 100 N, B = 40 N, C = 60°

c A = 20 N, B = 50 N, C = 40°

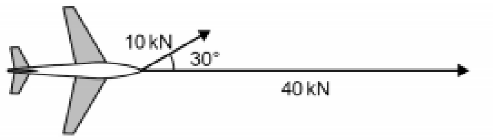


2 The diagrams show aeroplanes flying in different wind conditions.

a



b



For each aeroplane:

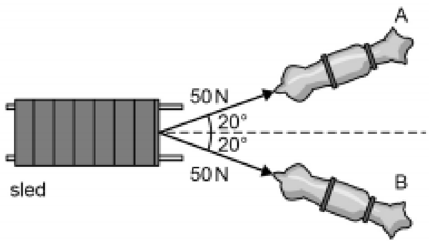
- explain the approximate direction in which the resultant force acts
- draw a scale diagram to help you work out the size and direction of the resultant force
- give the direction of the resultant as an angle from the direction in which the aeroplane is pointing.

3 The diagram shows a sled being pulled by two dogs. The sled is moving along the direction shown by the dotted line.

a Explain in which direction the resultant force is acting.

b Suggest approximately what size you expect the resultant force to be. Explain your reasoning.

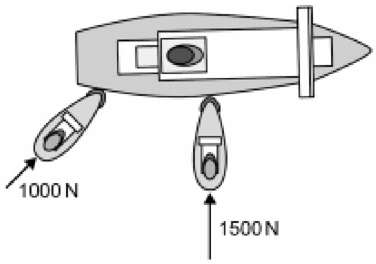
c Draw a scale diagram to help you work out the size and direction of the resultant force.



4 Two tug boats are pushing a ship. The angle between the two 'pushes' is 45°.

a What approximate size and in what approximate direction do you expect the resultant force to be? Explain your answer.

b Draw a scale diagram to help you work out the size and direction of the resultant force.



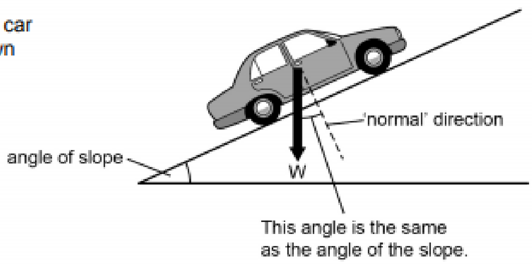
5 When a car is driven up a hill, part of its weight is acting normal to the surface, and part is acting to pull it down the hill.

Use scale diagrams to **resolve** the weight of the car into **components** normal to the surface and down the hill for these conditions.

a weight = 1200 N, angle = 10°

b weight = 2000 N, angle = 5°

c weight = 1500 N, angle = 20°



	distance travelled = average speed × time	
	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{(v - u)}{t}$
	force = mass × acceleration	$F = m \times a$
	weight = mass × gravitational field strength	$W = m \times g$
	efficiency = $\frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$	
HT	**momentum = mass × velocity**	$\boldsymbol{p = m \times v}$
	wave speed = frequency × wavelength	$v = f \times \lambda$
	wave speed = distance ÷ time	$v = \frac{x}{t}$
	density = mass ÷ volume	$\rho = \frac{m}{V}$
	work done = force × distance moved in direction of force	$E = F \times d$
	change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
	kinetic energy = ½ × mass × (speed)^2	$KE = \frac{1}{2} \times m \times v^2$
	power = work done ÷ time taken	$P = \frac{E}{t}$
	energy transferred = charge moved × potential difference	$E = Q \times V$
	charge = current × time	$Q = I \times t$
	potential difference = current × resistance	$V = I \times R$
	power = energy transferred ÷ time taken	$P = \frac{E}{t}$
	electrical power = current × potential difference	$P = I \times V$
	electrical power = current squared × resistance	$P = I^2 \times R$
	force exerted on a spring = spring constant × extension	$F = k \times x$

GCSE (9–1) Physics, you also need to learn these extra equations:

moment of a force = force × distance normal to the direction of the force	
pressure = force normal to surface ÷ area of that surface	$P = \frac{F}{A}$