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Examiners' Report
June 2018

GCSE Science 1SC0 2PF

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Introduction

This was the first examination of 'Physics 2PF', being paper 6 of Combined Science at Foundation Level, for the new specification. Questions were set to test students' knowledge, application and understanding from the seven topics in the specification:

- Topic 1 – Key concepts of physics
- Topic 8 – Energy - Forces doing work
- Topic 9 – Forces and their effects
- Topic 10 – Electricity and circuits
- Topic 12 – Magnetism and the motor effect
- Topic 13 – Electromagnetic induction
- Topic 14 – Particle model
- Topic 15 – Forces and matter

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth one or two marks each and longer questions worth three or four marks each. There was a new emphasis, too, in the inclusion of questions designed at targeting students' knowledge and understanding of practical work. This included assessing their fundamental knowledge of practicals specified in the specification, together with further application, especially where they were asked to propose improvements to a procedure. One assessment of practical work featured in the six-mark question 6d about measuring a student's power output.

Candidates coped well with most questions and did particularly well in the questions asking for calculations using equations. Students' knowledge of practical work, in contrast, was not so secure.

Successful candidates were:

- well-acquainted with the content of the specification
- skilled as a result of having been engaged with practical work during their course
- competent in quantitative work, especially in using equations
- well-focused in their comprehension of the question-at-hand
- willing to apply physics principles to the novel situations presented to them

Less successful candidates:

- had gaps in their conceptual knowledge of the topics of this paper
- had gaps in their procedural knowledge, relating to their practical work

- misread and/or misunderstood the symbols used in equations
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations

This report will provide exemplification of candidates’ work, together with tips and/or comments, for a selection of questions. The exemplification will come from responses which highlight successes and misconceptions, with the aim of aiding future teaching of these topics.

Question 1 (a) (i)

A great majority of candidates knew that electrical power is generated at **a power station.**

Question 1 (a) (ii)

The national grid, as the means of **transmission**, was known by a clear majority of candidates.

Question 1 (a) (iii)

The idea that the purpose of transmission at high voltages is so that **heat loss is reduced** was known by a clear majority of candidates.

Question 1 (c)

The vast majority of candidates scored all 2 marks here, with correct substitutions. Some candidates confused primary and secondary voltages though.

(c) In a small transformer

- the primary voltage is 230 V
- the primary current is 0.020 A
- the secondary voltage is 5.0 V

Calculate the secondary current.

Use the equation

$$I_s = \frac{V_p \times I_p}{V_s}$$

$$\frac{230 \times 0.020}{5.0} = 0.92$$

(2)

secondary current = 0.92 A

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Examiner Comments

This candidate sets out the substitution work very clearly, obtaining a correct final answer for 2 marks.

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Examiner Tip

Always show your working clearly. That way if you slip up on a calculation you may be awarded intermediate marks for the steps in coming to your final answer.

Question 2 (c)

Attainment was low on this question. The idea of **induced** magnetism was not well understood. Attempted explanations in terms of strange magnetic currents or through proposing adding more paper clips were seen. This is a 'how to' experimental question requiring an understanding of the practical work undertaken.

(c) Figure 2 shows a magnet holding some paper clips.

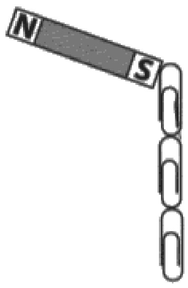

Figure 2

Describe how a student could show that the paper clips are induced magnets.

(2)

paper clips are an induced magnet because it is only a magnetic when its connected to a magnetic field. Use a magnet to attract the paper clips and when you remove the magnet, clips will fall.

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Examiner Comments

This candidate gains the full 2 marks for:

the idea of removing the magnet (/ field) (1 mark)

and then that upon removal the paper clips will themselves be no longer magnetic (1 mark)

This candidate has expressed themselves well.

ResultsPlus
Examiner Tip

Read your answer after composing. Does it make sense? Will the examiner understand it do you think?

Have you missed anything out?

Question 2 (d)

Most failed to grasp the relatively simple way you can show that the earth has a magnetic field viz. use a compass; it will always point north. A lot of candidates deliberated upon gravitational fields inappropriately. Once again, many candidates did not focus on the 'how to' experimental description that was required.

(d) Describe how you could show that the Earth has a magnetic field.

(2)

We can see that Earth has a magnetic ~~Fe~~ ~~Field~~ field by using a Ploting compose it will allways point to the north Pole.

ResultsPlus
Examiner Comments

2 marks:

use a plotting compass (1)

it will always point north (1)

ResultsPlus
Examiner Tip

There is great merit in keeping it simple (and effective, as this candidate did). Remember **'how could you show'** questions are all about **doing science**.

What will you do (experimentally)?

Question 2 (e) (i)

Most candidates succeeded in identifying the north pole. Some placed their 'N' symbol too far away from the end of the bar so that it could not be credited. In that vein some put the 'N' at the end of the arrow for the compass; this was inappropriate for the question, 'Mark the north pole **of the bar magnet** . . .'

(e) A student uses a compass to investigate the magnetic field near a bar magnet.

The student places the compass near the bar magnet as shown in Figure 3.

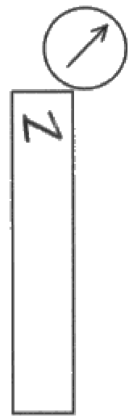

Figure 3

(i) Mark the north pole of the bar magnet with an 'N' in Figure 3.

(1)

ResultsPlus
Examiner Comments

Correct, 1 mark. The question said 'Mark the north pole **of the bar magnet**'.

ResultsPlus
Examiner Tip

Read the question carefully. Look at the diagram. Where is the bar magnet?

(e) A student uses a compass to investigate the magnetic field near a bar magnet.

The student places the compass near the bar magnet as shown in Figure 3.

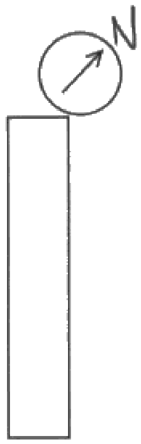

Figure 3

(i) Mark the north pole of the bar magnet with an 'N' in Figure 3.

(1)

ResultsPlus
Examiner Comments

No marks. The candidate appears to have marked the north pole of the plotting compass; this is not what was asked for.

ResultsPlus
Examiner Tip

Ask yourself 'Have I answered the question set?'

Think: the bar magnet has a north pole, so does the compass. Which am I asked to label?

See it. Sort it.

Question 2 (e) (ii)

A half of the candidates achieved some marks on this question. Some got one mark with a correct reference to the use of iron filings. Full achievement was seen in candidates who described moving a compass and tracing where the compass's N pole was pointing. Quite a number described 'using another magnet' to no effect.

(e) A student uses a compass to investigate the magnetic field near a bar magnet.

The student places the compass near the bar magnet as shown in Figure 3.

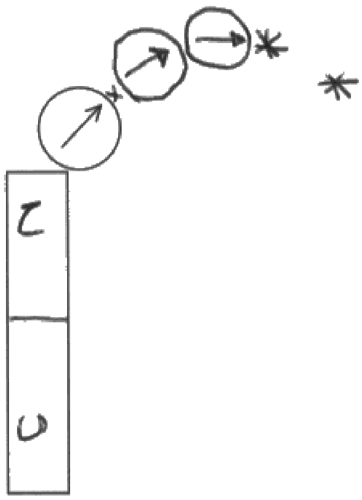

Figure 3

(i) Mark the north pole of the bar magnet with an 'N' in Figure 3.

(1)

(ii) State two ways in which the investigation could be developed to show the shape of the magnetic field around the bar magnet.

You may add to Figure 3 to help with your answer.

(2)

1 we could add more compasses to find the direction

2 we could plot each time we place ~~to~~ the compass with an "x" to find the shape

ResultsPlus
Examiner Comments

2 marks, well earned, as per mark scheme points 1 and 2:-

use a compass (1)

mark direction / plot (1)

The answer is enhanced by the candidate's sketch.

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Examiner Tip

A good picture, as seen added to Figure 3, communicates that you know what you are talking about. Once drawn all you, the candidate, have to do is to put it into words. This is exactly what the candidate did in this exemplary work.

Question 3 (b)

A good majority of candidates drew a vector arrow pointing downwards, gaining 1 mark. A third of the candidates went on to match the length of the force up arrow, gaining them the full marks.

(b) Figure 4 shows a box at rest on a floor.

The force that the floor exerts on the box is shown by the vector in Figure 4.

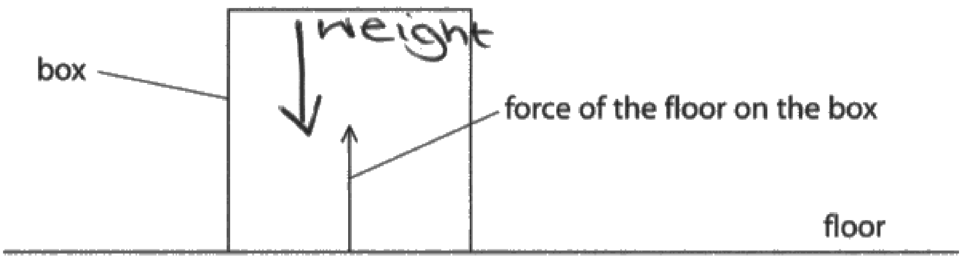


Figure 4

Add another vector to the diagram in Figure 4 to show the weight of the box.

(2)

ResultsPlus
Examiner Comments

Two marks were awarded. One for the arrow downwards and one for the matching length.

ResultsPlus
Examiner Tip

The arrow could have been drawn anywhere. This candidate has drawn it sensibly inside the box.

The forces must be balanced here (the box is stationary). Vector arrows have length representative of their sizes. Long arrow large force; short arrow small force.

(b) Figure 4 shows a box at rest on a floor.

The force that the floor exerts on the box is shown by the vector in Figure 4.

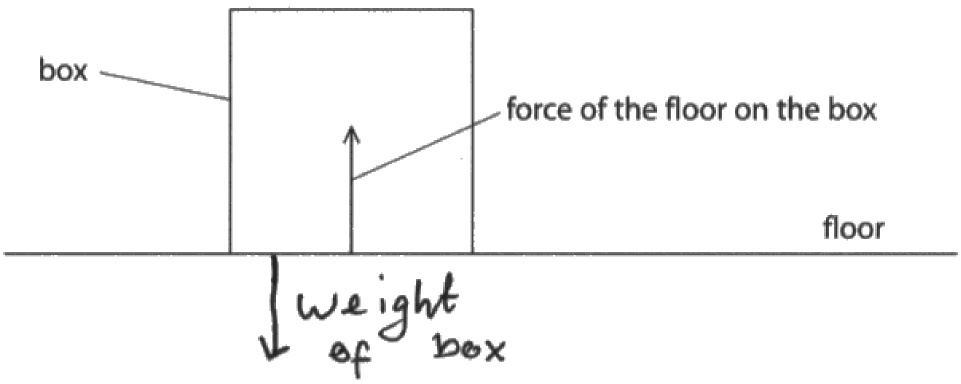


Figure 4

Add another vector to the diagram in Figure 4 to show the weight of the box.

(2)

ResultsPlus
Examiner Comments

One mark only was awarded here for the arrow being downwards.

Its length falls short of the upwards force significantly.

ResultsPlus
Examiner Tip

Use a ruler to draw vector arrows.

Think about the size of the forces involved.

If the box is at rest the forces on it must be **balanced.**

Question 3 (c) (i)

A good proportion of the candidates saw that friction was the cause of the warming but only a quarter of candidates went on to say that (heat) energy was transferred as a result.

(c) Figure 5 shows part of a cart.

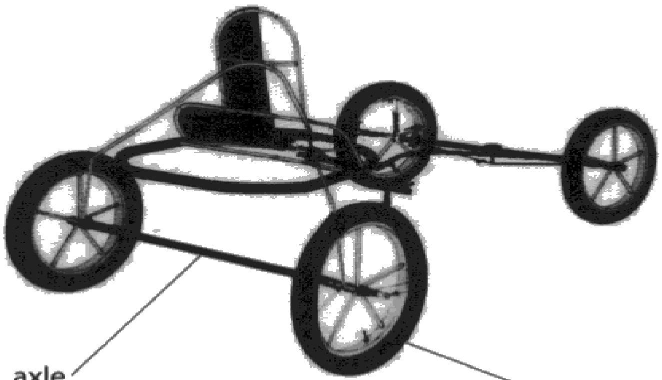


Figure 5

When the wheels turn the axles become warm.

(i) Explain why the axles become warm when the wheels turn.

(2)

Because frictan is caused by the axles turning and rubbing against the frame.

ResultsPlus Examiner Comments

1 mark for the comment on friction.

ResultsPlus Examiner Tip

Think "Have I answered the question 'why the axles become warm'?"

Think "What is the process involved?" A second mark was missed because of this lack.

(c) Figure 5 shows part of a cart.

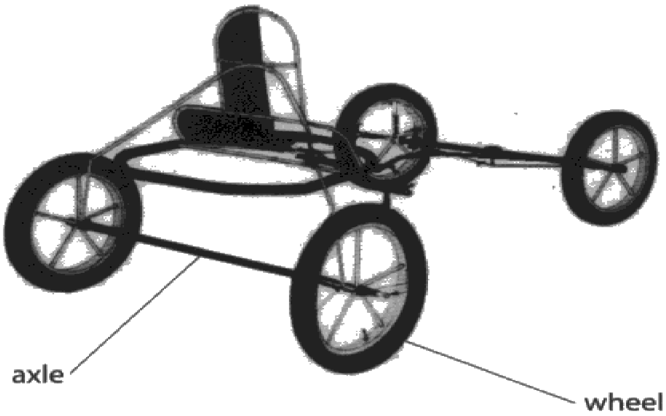


Figure 5

When the wheels turn the axles become warm.

(i) Explain why the axles become warm when the wheels turn.

(2)

Because the axles are rubbing against metal causing friction, and friction is causing it to heat up.

2 marks were awarded, one for the reference to friction / rubbing against and 1 for the process / transfer of heat.

There are alternative ways of saying 'it heats up'.

There is a transfer to thermal energy.

The rubbing generates heat.

What you mustn't say is that the friction warms it up; that's not identifying the process. 'Becomes warm' is in the question stem; there would be no good in just repeating that.

Question 3 (c) (ii)

Less than half got this right (oil / lubrication). Quite a lot of candidates described inappropriate cooling systems, or even proposed insulating the axles in some way.

(ii) Give **one** way of reducing the heating of the axles when the wheels turn. **(1)**

by going at a slower paste.

ResultsPlus
Examiner Comments

This is equivalent to 'go slower'. Examiners are quite relaxed about crediting answers that look phonetically OK.

The candidate meant 'slower pace': we wouldn't be harsh on their 'slower paste'

(ii) Give **one** way of reducing the heating of the axles when the wheels turn. **(1)**

Using a form of lubricant on the axle like cars have axle grease.

ResultsPlus
Examiner Comments

Correct answer for 1 mark.

Some everyday knowledge from cars and bicycles may help.

ResultsPlus
Examiner Tip

Exam questions are not there to trip you up.

Think of your everday experience as well. Oiling the stiff door hinge, your bicycle, the playground roundabout, e.g.

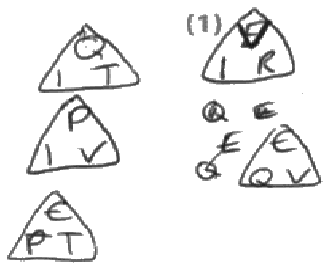
Question 3 (d)

There were some good answers seen to this part, but many showed confusion over the terms 'useful', 'total' and 'wasted'. Nevertheless, 1 mark was often obtained through a correct subtraction for part ii.

(d) (i) Complete the equation that relates efficiency, useful energy transferred by a device and total energy supplied to the device.

(1)

efficiency = Wasted energy ÷ Total energy



(ii) In one second an engine has a total energy input of 7500 J.

In one second 3200 J is transferred to the surroundings as wasted energy.

Calculate the useful energy transferred by the engine.

(1)

4300

useful energy transferred = 53.3 J

(iii) Calculate the efficiency of this engine.

(2)

7500 ÷ 60 = 125

3200 ÷ 60 = 53.3

efficiency of the engine = 53.3

ResultsPlus
Examiner Comments

Here's an example of where the candidate got muddled in their remembering of the equation.

They did get a mark for 3dii.

We are prepared to give an ecf mark in the last part. However in this case wasted / total should be 3200 / 7500 which the candidate hasn't got. So no marks.

(d) (i) Complete the equation that relates efficiency, useful energy transferred by a device and total energy supplied to the device.

(1)

efficiency = $\frac{\text{useful energy}}{\text{total energy}}$ × 100

(ii) In one second an engine has a total energy input of 7500 J.

In one second 3200 J is transferred to the surroundings as wasted energy.

Calculate the useful energy transferred by the engine.

7500 − 3200 = 4300 J

(1)

useful energy transferred = 4300 J

(iii) Calculate the efficiency of this engine.

(2)

efficiency = $\frac{\text{useful energy}}{\text{total energy}}$ × 100

$\frac{4300}{7500}$ × 100

= 57.3%

efficiency of the engine = 57.3%

ResultsPlus
Examiner Comments

Well set out. Well calculated. All three marks are given.

ResultsPlus
Examiner Tip

This question led candidates through. In the absence of such leading, when a calculation is required, remember the order:

- write down the equation in word or symbols
- rearrange if necessary
- substitute
- evaluate - carry out your calculation and write the final answer in the space provided

Question 4 (b) (i)

This was performed well, with many candidates scoring 2 / 2. They had to multiply the two numbers using the given equation.

(b) A lamp is connected to a potential difference of 0.24 V.

The current in the lamp is 0.12 A.

(i) Calculate the power of the lamp.

Use the equation

$P = I \times V$

(2)

0.12 × 0.24

power of the lamp = 0.0288 W

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Examiner Comments

Simply but clearly set out, meaning that the examiner could award an intermediate mark if there was a slip in the final arithmetic.

2 marks awarded. The answer in the mark scheme was 0.029 (W) with 0.0288 (W) being an acceptable unrounded alternative.

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Examiner Tip

Show your working to enable the credit of intermediate marks if you slip up on your calculator.

Question 4 (b) (ii)

Most candidates performed well on this question. However, a number took the time as 0.35s, spoiling their efforts; they still obtained 1 mark, though, via the power of ten error route.

(ii) The potential difference is changed to 0.30V.
The current in the lamp is now 0.13 A.

The lamp is switched on for 35 s.

Calculate the energy that is transferred in this time.
Select an equation from the list of equations at the end of this paper.

(2)

$E = I \times V \times t$

$0.13 \times 0.30 \times 0.35 = 0.01365$

energy transferred = 0.01365 J

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Examiner Comments

This shows an example where the candidate mistakenly transposes 35s to become 0.35s.

ResultsPlus
Examiner Tip

Candidates often read stopwatches incorrectly e.g. seeing 00:1837 and thinking it's 0.1837s when it is 18.37s. There is no reason to change 35 to 0.35 seconds in this case.

(ii) The potential difference is changed to 0.30 V.
The current in the lamp is now 0.13 A.

The lamp is switched on for 35 s.

Calculate the energy that is transferred in this time.
Select an equation from the list of equations at the end of this paper.

(2)

E = I × V × t

Energy transfered = current × potential difference × time

= 0.13 × 0.30 × 35

⇒ 1.37

energy transferred = 1.37 J

ResultsPlus
Examiner Comments

This is to show the contrast, with that above.

Wholly correct - 2 marks.

ResultsPlus
Examiner Tip

The candidate produces an exemplary answer:

- equation
- (clear) substitution
- evaluation, rounding off where necessary

Notice the candidate rounds off the final answer to 1.37 J very sensibly (most left it as 1.365 J, not penalised, but still not reflecting the best practice; there will be times when this matters)

Question 4 (b) (iii)

This was wholly successful for three quarters of candidates. Once again when candidates took the time as 0.35s they lost a mark because of that power of 10 error.

(iii) The current in the lamp stays at 0.13 A.

Calculate the charge that flows through the lamp in 35 s.
Use the equation

$Q = I \times t$ → time
↓ charge ↓ current

charge = current × time

charge = 0.13 × 35

charge = 4.55

4.5|5

= 4.6

(2)

charge = 4.6 **C**

ResultsPlus
Examiner Comments

Wholly correct 2marks.

This candidate has added explanatory power, so that a safety net existed should he/she slip up in a calculation.

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Examiner Tip

This answer represents best practice.

Uses the steps of write equation down, explaining terms, followed by showing the substitution, followed by a final evaluation.

The candidate also follows best pratice in rounding the final answer to 2 significant figures, since the readings given are each to 2 sf.

Question 4 (c)

Most candidates saw the basic link that as voltage increases current increases (in the main). Most identified that the 0.13A current staying constant at the end baulked this trend. Many candidates seemed to know about direct proportionality, although much fewer managed to verbalise why this wasn't evident with this data. Candidates did not always make clear which part of the statement they were supporting or contradicting.

(c) A student measures the current in the lamp for several values of potential difference across the lamp.

Figure 7 shows the student's results.

potential difference across the lamp in volts (V)	current through the lamp in amps (A)
0.06	0.05
0.12	0.08
0.18	0.10
0.24	0.12
0.30	0.13
0.36	0.13

Figure 7

The student uses the results in Figure 7 to write this conclusion.

'As the potential difference across the lamp increases, the current in the lamp increases and the relationship is directly proportional.'

Comment on the student's conclusion.

(3)

Not directly proportional as the current doesnt increase by a constant number like the voltage does. At 0.3V the current remains at 0.13A.

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Examiner Comments

This candidate scores 3 marks for:

'not directly proportional' (1 mark)

'doesn't increase by a constant number' (1 mark)

and the stays constant (at the end) reasoning (1 mark)

ResultsPlus
Examiner Tip

You can spell things out in sentences or use bullet points - this candidate has almost done that in the short sharp statements made.

(c) A student measures the current in the lamp for several values of potential difference across the lamp.

Figure 7 shows the student's results.

potential difference across the lamp in volts (V)	current through the lamp in amps (A)
0.06	0.05
0.12	0.08
0.18	0.10
0.24	0.12
0.30	0.13
0.36	0.13

Figure 7

The student uses the results in Figure 7 to write this conclusion.

'As the potential difference across the lamp increases, the current in the lamp increases and the relationship is directly proportional.'

Comment on the student's conclusion.

(3)

The conclusion is wrong because as the potential difference increases the current increases until it gets to 0.36 when it is the same as 0.3. This shows they are not directly proportional.

ResultsPlus
Examiner Comments

This candidate scores via a slightly different route to the first candidate:

'as the p.d. increases the current increases' (1 mark)

'until' argument, well expressed (1 mark)

'not directly proportional' (1 mark)

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Examiner Tip

If a 'comment on' question has 3 marks try to say three separate things, as both these students successfully did.

Question 5 (a) (i)

Most candidates obtained 1 or 2 marks out of 4 on this question. These candidates typically mentioned measuring temperature, and some talked about measuring the mass, or volume, of the water. Only a minority of candidates cited measuring initial and final temperatures or taking reading(s) from the joulemeter. Quite a number of candidates talked of measuring the 'amount' of water; 'amount' is insufficient being not specific enough.

5 (a) A student uses the apparatus in Figure 8 to determine the specific heat capacity of water.

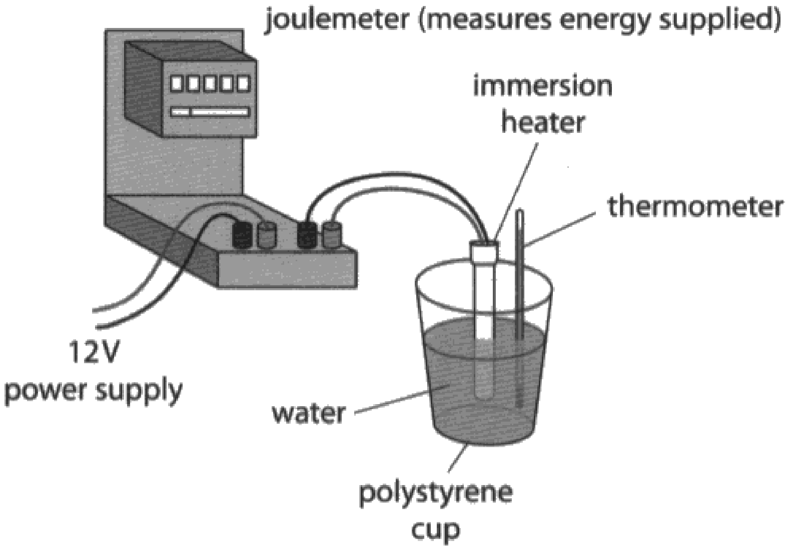

Figure 8

(i) State the measurements needed to calculate the specific heat capacity of water.

(4)

~~Yes~~ The measurements needed to calculate the specific heat capacity of water is the mass of the water, the temperature at the start and end and also the measure of energy supplied.

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Examiner Comments

This simply written answer hits all 4 mark points in a very clear manner.

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Examiner Tip

Remember not to use vague terms like 'amount of water'; this cannot be credited. Think back into the lab. 'State the measurements' answers the question 'What would you measure?'. Be precise. If possible also make it clear which measuring instrument is used in each case. This candidate did not do that but, nevertheless, obtained all 4 marks. To make marks more secure please do consider those measuring instruments involved as well though.

Question 5 (a) (ii)

This question was about improving a procedure. It was poorly answered by the clear majority of candidates. There were very many insubstantial unhelpful comments seen such as 'use a plastic cup' or 'use more water'. Perhaps more candidate evaluations of their experiments might improve this aspect of candidates' procedural understanding. Adding a lid was the most popular correct answer, whilst some scored a mark with a suggestion of 'use a digital thermometer'.

(ii) State **two** ways that the apparatus could be adapted to improve the procedure.
(2)

1 Larger glass of water

2 A higher power supply

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Examiner Comments

These proposals would not necessarily improve the procedure, so there was no rationale to include them in the mark scheme.

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Examiner Tip

Occasionally candidates do come up with alternatives that could be worthy. However they must be justified. Think 'How would the proposal improve the experiment?'

(ii) State **two** ways that the apparatus could be adapted to improve the procedure.

(2)

1 Add a lid to the polystyrene cup.

2 Add an extra layer around the cup for example: cotton wool ~~or~~, bubble wrap or a second cup.

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Examiner Comments

This answer hits mark points 1 and 2 on the mark scheme. The proposals reduce heat losses and so will improve the desired outcome of a more accurate calculated value of specific heat capacity.

Question 5 (b)

Only a minority gave answers within the mark scheme's accepted range (95 to 102° C). Most seemed to have simply extrapolated the line, without due regard for the limiting effect of the boiling point of water.

Question 5 (c)

Most scored one mark out of two on this question. In these cases, candidates had the correct idea of multiplying the two numbers together but failed to convert 380g to kg to get the correct answer in Joules.

(c) Another student decides to melt some ice.

The student melts 380 g of ice at 0 °C.

The specific latent heat of fusion of ice is 3.34×10^5 J/kg.

Calculate the thermal energy needed to melt the ice.

Select an equation from the list of equations at the end of this paper.

(2)

$Q = m \times L$

$Q = 380 \times 3.34 \times 10^5$

$Q = 380 \times 334000$

$Q = 126920000$

$Q = 1.2692 \times 10^8$

thermal energy needed = 126920000 J

ResultsPlus
Examiner Comments

This candidate scores 1 mark.

The error is in not converting the 380g into 0.380kg.

With the specific latent heat in J / **kg**, that conversion is essential.

ResultsPlus
Examiner Tip

In physics we invariably use metres, kilograms and seconds. Aim to use those units unless you have a solid reason not to.

(c) Another student decides to melt some ice.

The student melts 380 g of ice at 0 °C.

The specific latent heat of fusion of ice is 3.34×10^5 J/kg.

Calculate the thermal energy needed to melt the ice.

Select an equation from the list of equations at the end of this paper.

(2)

Q = m x L

0.38 kg x 334000 J/kg = 126920

380g x (3.34×10^5 J/kg)

thermal energy needed = 126920 J

ResultsPlus
Examiner Comments

This candidate scores the full two marks for the question.

They convert the 380g to 0.380 kg, making clear their working as they go along.

ResultsPlus
Examiner Tip

Notice the way the candidate sets out their answer. The clarity with which they proceed is exemplary, especially in that conversion from g to kg.

Question 5 (d)

Three quarters of the candidates didn't recall the density equation correctly. They either took volume ÷ mass or volume x mass. Candidates acquire a good feel for the notion of density by handling various objects – blocks of wood or aluminium e.g. and then measuring densities via their core practical work. So they shouldn't fail at this question to the extent to which they did; a quarter of candidates did succeed in recall and substitution.

Question 6 (a)

Two thirds of candidates correctly substituted into the given equation. No marks were given if the candidate failed to square the velocity.

6 A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

(a) Calculate the kinetic energy of the cyclist and bicycle.

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

(2)

$\frac{1}{2} \times 68 \times 12^2 =$

kinetic energy = 4896 J

ResultsPlus
Examiner Comments

This candidate shows their working and their answer in an exemplary manner.

ResultsPlus
Examiner Tip

Compare this answer with the one below in terms of use of units. This one is wholly correct, the next one is spoilt.

6 A cyclist is riding a bicycle at a steady velocity of 12 m/s.

The cyclist and bicycle have a total mass of 68 kg.

(a) Calculate the kinetic energy of the cyclist and bicycle.

Use the equation

1kg = 1000g

$$KE = \frac{1}{2} \times m \times v^2$$

68kg = 68000g

(2)

1/2 x 68000 x 12² = 489,6000

kinetic energy = 489,6000 J

ResultsPlus
Examiner Comments

This candidate scores 1 mark, having produced a power of ten error.

The mistake was in writing the mass in grams, which spoilt it here.

ResultsPlus
Examiner Tip

Kilograms may be in thousands of grams but remember we work in kilograms, metres and seconds as our primary units. Use those and you will be secure in your working.

When you work out joules it **always** assumes you have put a mass in kg into your equation.

Question 6 (b)

A minority showed themselves capable of spelling out the energy transfer involved. Some showed confusion with the earlier question (3c) and discussed friction without entering into the focus of the question – **energy transfers**.

(b) Describe the energy transfers that happen when the cyclist uses the brakes to stop.

(2)

The energy transfers ~~into~~ from kinetic energy, into thermal energy and dissopates into the surroundings.

ResultsPlus
Examiner Comments

For the 2 marks we needed a statement of first the energy store, for one mark, followed by the second end point store for the second mark.

This scores both marks.

ResultsPlus
Examiner Tip

Compare **this full statement** with the partial answer in the second clip, below this one.

(b) Describe the energy transfers that happen when the cyclist uses the brakes to stop.

(2)

there is a sudden drop in KE and seen a graduate decrease in velocity

ResultsPlus
Examiner Comments

This scores one mark for the decrease in kinetic energy comment.

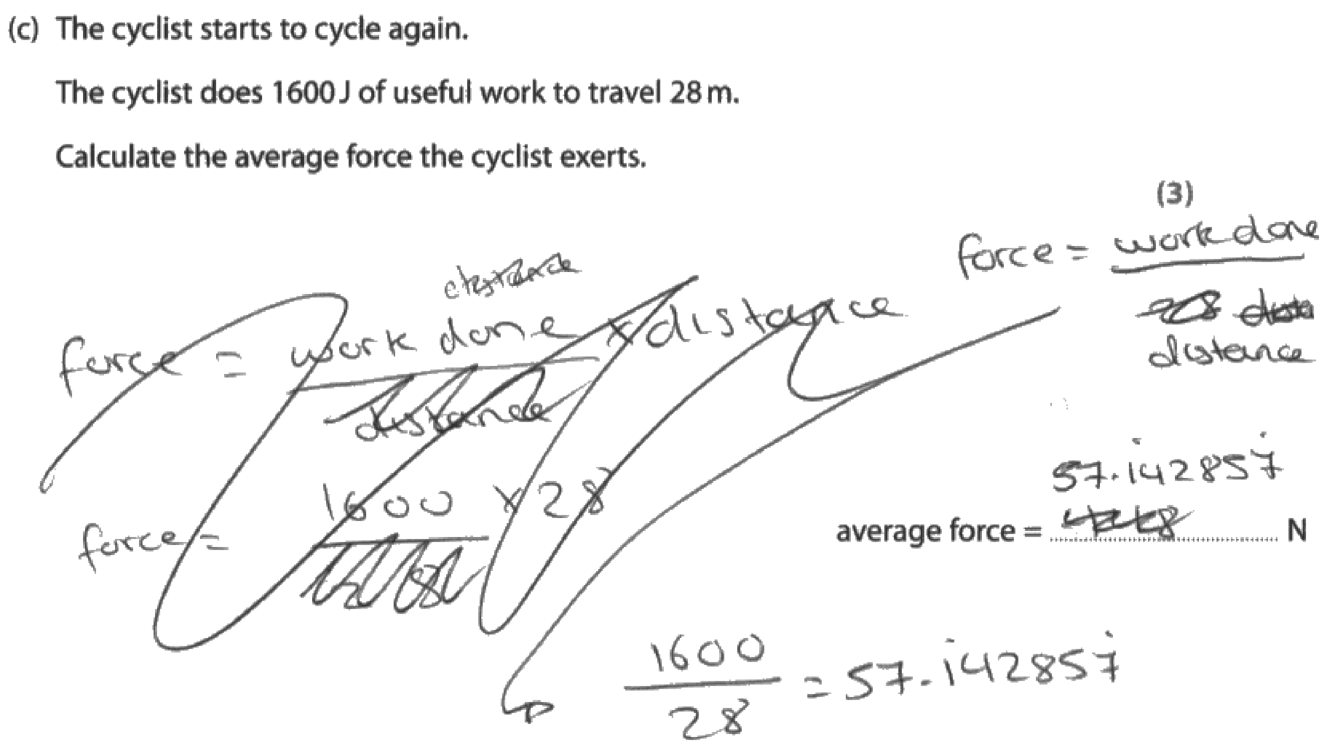
ResultsPlus
Examiner Tip

This is a partial answer. What then happens to that energy? Where does it get transferred to?

The question asks for the energy transfer, so there is nothing to be credited in the statement about a decrease in velocity.

Question 6 (c)

The responses to this question tended to be all or nothing. Some cited the equation correctly, then rearranged it and finally substituted correctly. Those who followed this three-stage process succeeded. Unfortunately, a majority simply either multiplied the numbers or used a wrong fraction.


(c) The cyclist starts to cycle again.

The cyclist does 1600 J of useful work to travel 28 m.

Calculate the average force the cyclist exerts.

(3)

force = work done × distance

force = 1600 × 28

force = work done / distance

average force = 57.142857 N

$\frac{1600}{28} = 57.142857$

ResultsPlus Examiner Comments

This candidate seems to self-correct and, in doing so, presents a fully correct answer for 3 marks.

ResultsPlus Examiner Tip

Remember the three stage process advised - write down the equation correctly, then rearrange it, and finally substitute correctly.

This candidate missed out starting at Work done = force x distance, but then they picked up the rest of it well.

Question 6 (d)

Coherent plans were few and far between. The responses to this question showed, first and foremost, a lack of understanding of the term '**power**'. Secondly there was a lack of familiarity with the suggested practical work. Many took 'steps' as being horizontal with little idea of the concept of 'work done' being involved. Many embarked on comparing the two methods in vague and insubstantial ways. Quite a number equated power with the ability to hold increasing masses up for periods of time. They seemed to be equating power with strength. Very few employed useful diagrams. Some described inappropriate experiments, notably the core practical of stretching a spring, which was not relevant to this question. Some even proposed measuring heart-rates and body mass indices as part of their investigations.

*(d) A class of students investigate the power output of each student in the class.

The class must decide whether they use a method using steps or a method using weights. The whole class must use the same method.

Plan what measurements the students should take and how these can be used to calculate and compare the power output of each student.

You may draw a diagram to help with your plan.

(6)

Power
a.c – alternate current
d.c – direct current
weight – Scale balance
a.c – d.c

To measure the power output, students need to make measure the direct current and alternate current. The students needs to use a joulemeter to measure the power supplied. It's easier to use weights because it can tells the energy that is being transferred.

ResultsPlus
Examiner Comments

This is a level 1 answer by virtue of 'a disconnected measurement, such as weight'. However a full level 1 of 2 marks could not be given because the answer is so incomplete and so flawed. Bringing a.c. and d.c. into it highlights the fact that this is a muddled and confused answer.

ResultsPlus
Examiner Tip

It is important to grasp the key ideas behind experiments; that way you can avoid the pitfalls of going off on an irrelevant path.

Reflection, after experiments, will help you make the most of them. Ask yourself:

- What was the aim of this experiment?
- What did I learn from this experiment?
- How would I make it better if I did it again?

*(d) A class of students investigate the power output of each student in the class.

The class must decide whether they use a method using steps or a method using weights. The whole class must use the same method.

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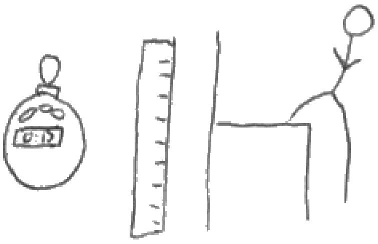
(6)



The Students should find Some steps or a chair. Get a large ruler and measer how high the chair is aswell as the height of the Student. Then time on a Stopwatch how long it takes to Step on and off the chair a Set number of times. Then compare how long it took the Students to Step on and off the chair

ResultsPlus
Examiner Comments

Now we see a level 2 answer. 4 marks were given for this simple incomplete plan.

ResultsPlus
Examiner Tip

In this example relevant proposed measurements are included - the height of the step-ups and the time it takes for completing a set number of steps. The quantitative aspect is missing though, limiting this response to a level 2.

The candidate has missed out answering a key part of the question - how your measurements can be used to calculate . . .

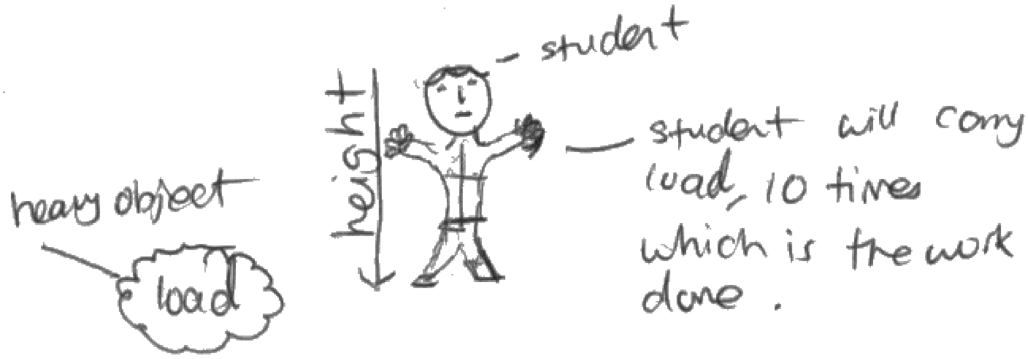
*(d) A class of students investigate the power output of each student in the class.

The class must decide whether they use a method using steps or a method using weights. The whole class must use the same method.

Plan what measurements the students should take and how these can be used to calculate and compare the power output of each student.

You may draw a diagram to help with your plan.

(6)



~~Power = work done / time taken~~

First, each student must take an object that weighs ~~the so~~ the same and lift ~~it 10 times~~ the object about 10 times and record how long it took you to lift the object 10 times to the level of your shoulder using a stop watch. You must measure the height of each student to determine the trend of power output of each student. Record ~~every~~ the results and calculate the power. Power = work done divided by the time taken. to work out the power output. After this ~~you can put th~~ ~~mak~~ the students line up in increasing order of power output.

ResultsPlus
Examiner Comments

This is a level 3 answer, with a clear methodology and a clear statement of how the intended result may be found by calculation.

A full 6 marks was awarded.

This answer is not perfect, by any means, but remember to continue to think that there is room for more marks above 6 in your mind. Even though we don't give them because of the limit of marks available in the paper altogether

ResultsPlus
Examiner Tip

Aim to spell out all the measurements you should take plus what you would do with those measurements to obtain a final result.

A drawing assists describing a method, as is the case here.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- They should make the most of opportunities afforded in their laboratories where they engage with practical work, with both core practicals and the suggested practicals. They should always question in their minds what the purpose of particular practical work is for and follow it up with evaluative work to consider how that experiment may be improved upon. In examinations candidates should respond to the command words 'Describe how a student could show. . .'by describing experimental procedures. They should not digress on to theoretical explanations in that regard.

- Some equations in physics are required to be learnt. Candidates in this exam fell down on two in particular of those – density and work done. Candidates should be able to recall and apply all twenty equations from the combined science specification.

- The use of wrong units causes candidates to miss out on quite a number of marks. A focus needs to be made on the use of metres, kilograms and seconds, as well as derived units e.g. the joule, which requires metres, kilograms and seconds in calculations to end up with energy in joules.

- Candidates seem to need more practice on handling powers of ten in their calculations. They should be able to use their calculators with number in standard form when needed.

- In constructing explanations candidates need to take note of the marks allocated to a particular question and respond with a corresponding number of points in their answer. Candidates should take opportunities, where they can, to use diagrammatic illustrations to aid and prompt their explanations.

- Candidates need to engage more in explanations that involve energy stores and energy transfers. That engagement needs to be made throughout the course, taking opportunities to explore language that can convey meanings better; this examination has revealed weaknesses in that area.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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