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Examiners' Report
June 2023

Int GCSE Single Science 4SS0 1P

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June 2023

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Introduction

This was the fourth Summer series Physics examination for the International GCSE Single Award Science qualification. Questions were set to assess candidates knowledge, understanding and application of Physics from all eight topics in the specification. This year, candidates were provided with a full formulae sheet for the examination, which removed the requirement to recall any of the formulae.

The examination was written to assess across the full range of grades from 1 to 9. Consequently, some questions were written to be challenging whilst others were designed to be more straightforward and accessible. A range of different question types were included in the examination such as objective and multiple choice, calculations and both short and long written responses. Approximately 20% of the marks available in the examination were for candidates' demonstration of experimental skills and understanding.

Successful candidates were well-acquainted with the content of the specification and could recall facts whilst applying their understanding to new and complex situations. They were competent in performing quantitative work and could rearrange formulae to obtain the correct answer. Successful candidates also showed evidence of undertaking all the required practicals themselves and could produce detailed, coherent methods whilst recalling the relevant results of these experiments.

Less successful candidates showed gaps in their knowledge of topics and either had limited experience or could not recall information from the required practical tasks. These candidates often did not address the demands of the question and overlooked the importance of the command words being used.

Question 1 (b)(ii)

Only a third of all candidates were able to answer this question correctly. Most candidates read the value of velocity from the y-axis and gave an answer of 8.0, which showed they did not understand that the acceleration was linked to the gradient of the graph.

Question 1 (b)(iii)

Most candidates did not recall that the distance travelled should be determined from the area under the graph. Most candidates opted to use the speed = distance / time formula, which usually resulted in an answer of 16m, which did not score any marks. More able candidates understood they needed to calculate the area of a triangle and obtained correct answers. However, a small number of candidates lost marks due to reading data from the graph incorrectly.

(iii) Calculate the distance travelled during the first 2.0 seconds of the motion of the ball.

(3)

$= \frac{1}{2} \times 8 \times 10 = 40$

$= 40$ metres.

distance travelled = 40 m

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Examiner Comments

This response scored 1 mark. The use of a factor of a half was deemed sufficient to show that the candidate was calculating the area of a triangle. The use of incorrect data prevented further marks from being awarded.

(iii) Calculate the distance travelled during the first 2.0 seconds of the motion of the ball.

(3)

distance = area under the graph

area = $\frac{1}{2} \times b \times h$

= $\frac{1}{2} \times 2 \times 8$

= 8 m //

distance travelled = ...8.......... m

ResultsPlus
Examiner Comments

This response scored 3 marks. The working is clearly laid out and the final answer is correct.

ResultsPlus
Examiner Tip

Candidates should know how to use velocity-time graphs to determine acceleration and distance travelled.

Question 2 (a)

Q02(a)(i) was more commonly correct that Q02(a)(ii) and more than half of all candidates scored 3 marks for this. However, a common error was dividing the values of 21 and 0.34, which showed an inability to rearrange formulae. Some candidates thought there needed to be a subtraction of values rather than addition in Q02(a)(ii), which was possibly due to mistaking braking distance for stopping distance.

2 A car is moving at a speed of 21 m/s. The driver of the car sees a hazard in the road and applies the brakes.

(a) (i) Calculate the thinking distance if the driver of the car has a reaction time of 0.34 s.

(3)

$$\frac{21}{0.34} = 61.76$$

thinking distance = 61.8 m

(ii) The braking distance of the car is 8.2 m.

Calculate the stopping distance of the car.

(2)

$$61.8 + 8.2 = 69.9 \approx 70$$

stopping distance = 70. m

ResultsPlus
Examiner Comments

This candidate has made a mistake in calculating the thinking distance and received no marks. However, they have added their thinking distance to the braking distance and so received 2 marks in Q02(a)(ii).

2 A car is moving at a speed of 21 m/s. The driver of the car sees a hazard in the road and applies the brakes.

(a) (i) Calculate the thinking distance if the driver of the car has a reaction time of 0.34 s.

(3)

21 × 0.34 = 7.14

thinking distance = 7.14 m

(ii) The braking distance of the car is 8.2 m.

Calculate the stopping distance of the car.

(2)

7.14 + 8.2 = 15.34

stopping distance = 15.34 m

ResultsPlus
Examiner Comments

This response is completely correct for full marks.

Question 2 (b)

Most candidates wrote the correct formula in Q02(b)(i) due to the inclusion of the full formulae booklet. It was very encouraging to see most candidates also achieve the correct answer in the subsequent calculation, especially since it required rearrangement of the given formula. Those candidates who lost marks usually rearranged the formula incorrectly or, unnecessarily converted kilograms to grams.

(b) (i) State the formula linking force, mass and acceleration.

(1)

(ii) The car has a mass of 780 kg and a braking force of 21 000 N.

Calculate the acceleration of the car due to the braking force.

(3)

acceleration = $\frac{21000}{780}$

acceleration = 26.9 m/s^2

ResultsPlus
Examiner Comments

This candidate has the correct answer for Q02(b)(ii), but the equation triangle shown in Q02(b)(i) did not score any marks. Candidates are expected to write a full formula in these questions, however they can use correct symbols instead of words if they prefer.

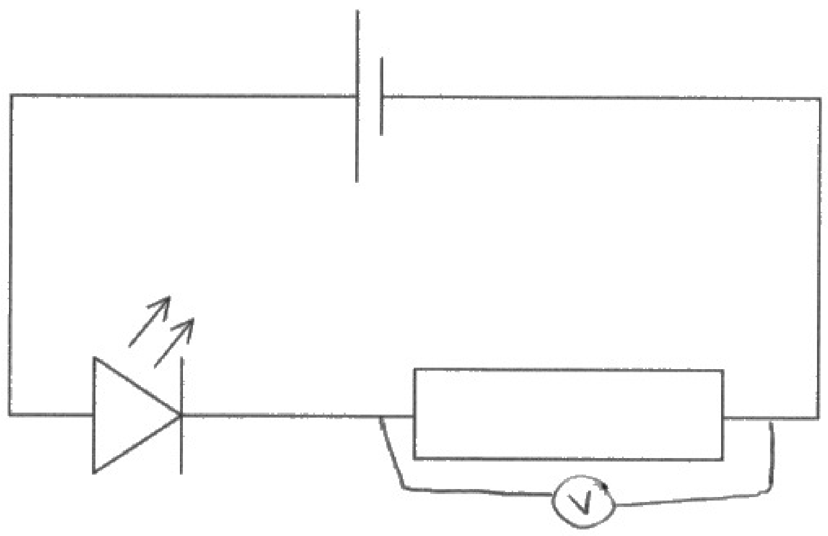
ResultsPlus
Examiner Tip

Equation triangles will not be accepted as a valid representation of a formula.

Question 3 (a)

The majority of candidates had a strong recall for the correct symbols in this question and the ammeter was particular well located in the circuit. However, the voltmeter position was less accurate, sometimes appearing in series.

3 The diagram shows a circuit containing a light emitting diode (LED) and a resistor.

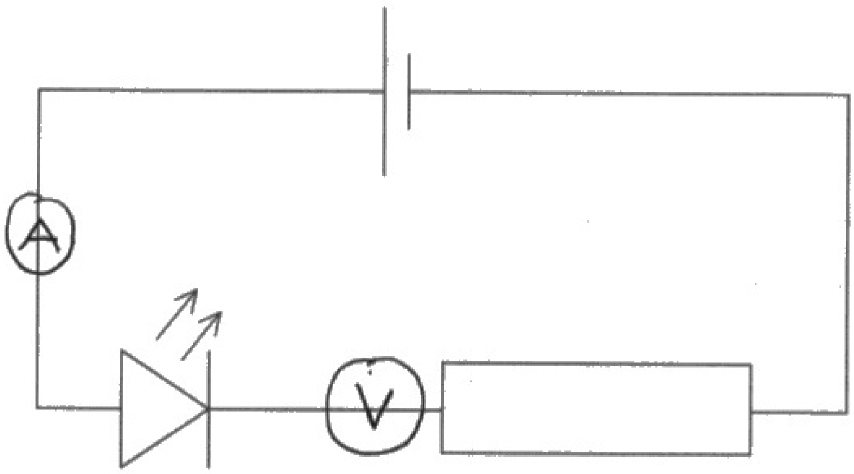


(a) Add meters to the diagram to measure the voltage of the resistor and the current in the resistor.

ResultsPlus
Examiner Comments

This candidate has misinterpreted the question and only included one meter in the circuit. However, the voltmeter is appropriately positioned and so 1 mark was awarded.

3 The diagram shows a circuit containing a light emitting diode (LED) and a resistor.

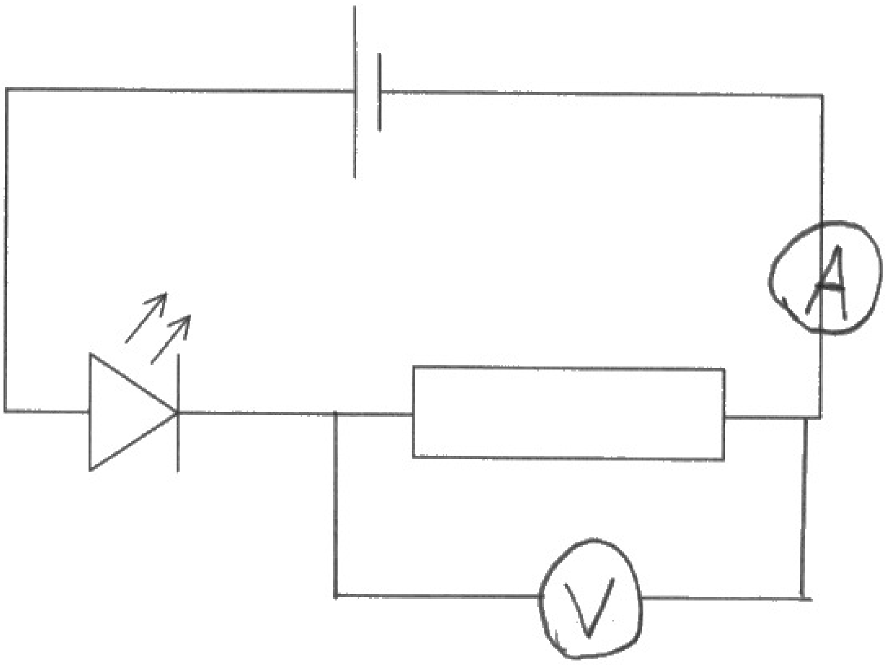


(a) Add meters to the diagram to measure the voltage of the resistor and the current in the resistor.

ResultsPlus
Examiner Comments

This response scored 2 marks. The circuit symbols for both meters are correct and the ammeter is appropriately positioned. However the voltmeter being drawn in series with the resistor is incorrect.

3 The diagram shows a circuit containing a light emitting diode (LED) and a resistor.



(a) Add meters to the diagram to measure the voltage of the resistor and the current in the resistor.

ResultsPlus
Examiner Comments

A fully correct answer that was awarded full marks.

Question 3 (b)

Most candidates scored at least 3 marks overall in these questions, but most lost a mark for not converting the current from mA to A in Q03(b)(ii). Weaker candidates experienced difficulties rearranging the formula. However, almost all candidates scored the mark in Q03(b)(i) for extracting the correct formula from the formulae booklet.

(b) (i) State the formula linking voltage, resistance and current.

(1)

Voltage = Current x resistance

$V = I \times R$

(ii) The current in the resistor is 7.3 mA.

The voltage of the resistor is 0.92 V.

Calculate the resistance of the resistor.

(3)

$R = V/I$

$R = \frac{0.92}{7.3} =$

resistance = 0.13 Ω

ResultsPlus
Examiner Comments

This candidate only scored 2 marks in Q03(b)(ii) as they have not converted mA to A.

ResultsPlus
Examiner Tip

Candidates are expected to know how to convert to standard units when completing calculations and to be familiar with the prefix milli, m.

(b) (i) State the formula linking voltage, resistance and current.

(1)

Voltage = current x resistance

(ii) The current in the resistor is 7.3 mA.

The voltage of the resistor is 0.92 V.

Calculate the resistance of the resistor.

(3)

7·3mA = 0·0073A

$$\frac{0{\cdot}92V}{0{\cdot}0073A} = 126{\cdot}03\Omega$$

resistance = 126 Ω

ResultsPlus
Examiner Comments

A fully correct answer that was awarded full marks. This time, the candidate has correctly converted the current from mA to A before attempting the calculation.

Question 4 (a)

This question was poorly answered by most candidates. Many candidates put answers such as nuclear reactors, x-rays, medical treatments, tracers and light emitters and all of these were not credited.

Question 4 (b)

Most candidates scored at least 1 mark in this question. The most common marks awarded were for killing/damaging/mutating cells and cancer. Some candidates answered with the burns marking points and even fewer mentioned radiation poisoning. There were very few misconceptions displayed when answering this question.

Question 4 (c)

The most common marks awarded in this question were for candidates demonstrating their understanding of what the three types of radiation were stopped by. A relatively common misconception was that alpha could travel through paper, beta could travel through aluminium and gamma could travel through lead. Few candidates discussed relevant experimental details such as measuring count rates and background radiation or the names of relevant measuring equipment. However, when these were mentioned, it usually indicated a candidate that was working beyond Grade 7.

(c) A technician has three radioactive sources. The sources look identical.

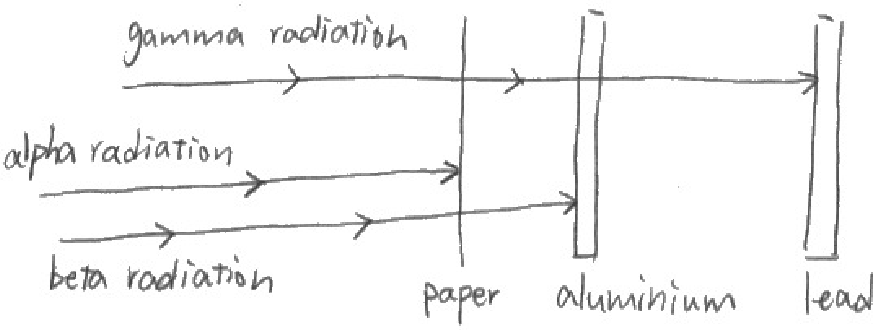
One source only emits alpha radiation, one source only emits beta radiation and one source only emits gamma radiation.

The technician has samples of paper, aluminium and lead.

Describe how the technician can determine which source emits each type of radiation.

You may draw a diagram to help your answer.

(5)



Put paper, aluminium and lead in order, shoot alpha rays ~~radiation~~ to those three, and it will stop when it touch the paper, ~~Pa~~ then shoot beta ~~radiation~~ rays, it will ~~go~~ pass the paper and stop by aluminium when touch it. At last, shoot gamma rays to those three samples, gamma rays will ~~s~~ pass through paper and aluminium, ~~stop~~ ~~t~~ ~~ea~~ stop by lead.

The investigation is ~~go~~ ~~x~~ ~~eq~~ alpha radiation can stop by paper, ~~be~~ beta radiation can stop by aluminium, gamma radiation can stop by lead.

ResultsPlus
Examiner Comments

This response was awarded 3 marks. The candidate has shown valid physics knowledge but has failed to link this to a valid description of an experimental method. It is worth noting that the diagram in this response is good enough on its own to award 3 marks.

ResultsPlus
Examiner Tip

Candidates should take advantage of the opportunity to include diagrams with their responses. Usually, marks can be awarded for these in addition (or instead of) what is included in the written part of their response.

(c) A technician has three radioactive sources. The sources look identical.

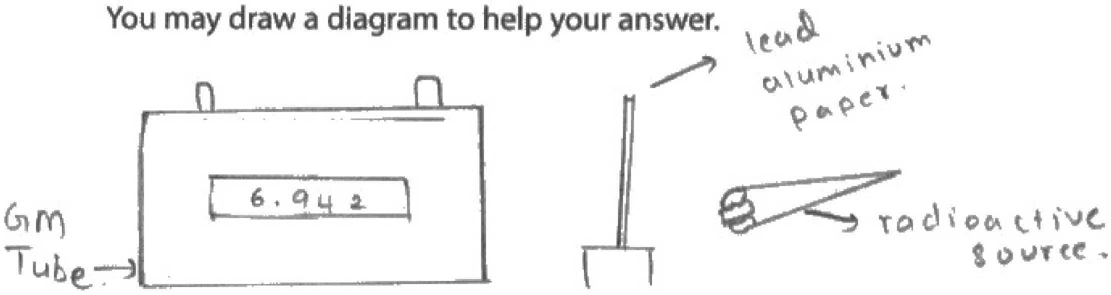
One source only emits alpha radiation, one source only emits beta radiation and one source only emits gamma radiation.

The technician has samples of paper, aluminium and lead.

Describe how the technician can determine which source emits each type of radiation.

You may draw a diagram to help your answer.

(5)



The technichian can ~~use~~ Keep the radioactive Sample at a particular distance away from the Geiger muller Counter. The reading will be displayed in the counter, that is the rate of disintegration per second. Then Keep the sheet of paper in the middle as a barrier, if the countrate drops, it shows that the ray cannot pentrate through the paper we can conclude that it is alpha radiation. Then Keep the sheet of aluminium, if the countrate drops after keeping this sheet we can conclude that it is beta radiation, this is because beta ~~particle~~ rays cannot penerate through aluminium And if the countrate still doesn't drop then use the sheet of lead, if the countrate drops, we can conclude that it is gamma radiation, because gamma has a high penrating power which only lead sheet can be used to stop it.

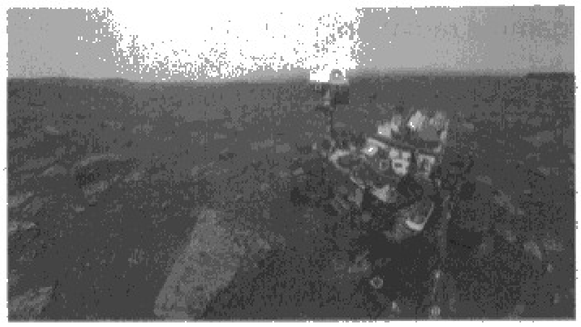
ResultsPlus
Examiner Comments

An excellent response that was awarded full marks. Fully workable methods, such as this one, were usually indicative of a candidate working at about Grade 7.

Question 5 (a)

Most candidates referred to collisions, but some responses did not make it clear that these collisions were between the molecules and the walls of the balloon. Consequently, more than half of all candidates failed to score in this question. Better responses usually scored the first marking point, but only candidates working above Grade 7 could make links between the collisions and the pressure.

5 The photograph shows a robotic vehicle called Opportunity. Opportunity landed on Mars in 2004.



(Source: © Dima Zel/Shutterstock)

Several large balloons protected Opportunity during landing.

(a) Explain how the gas molecules inside a balloon exert a pressure on the inside surface of the balloon.

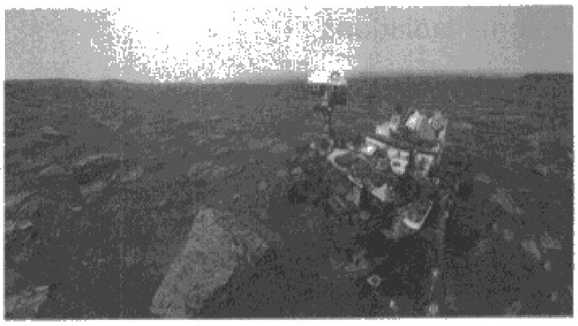
(3)

Gas particles have a high kinetic energy. This means they move around quickly colliding into the balloon as diffusion may occur, but the gas particles are track in the balloon. This causes high pressure inside the balloon.

ResultsPlus
Examiner Comments

This response shows some misconceptions but is clear enough that the molecules collide with the balloon. Therefore, 1 mark was awarded.

5 The photograph shows a robotic vehicle called Opportunity. Opportunity landed on Mars in 2004.



(Source: © Dima Zel/Shutterstock)

Several large balloons protected Opportunity during landing.

(a) Explain how the gas molecules inside a balloon exert a pressure on the inside surface of the balloon.

(3)

The gas molecules collide with the surface of the balloon and this produces a force. Pressure is equal to $\frac{force}{area}$.

ResultsPlus
Examiner Comments

An excellent, concise response that was awarded full marks.

Question 5 (b)(i)

The distribution of marks in this question was exceptionally similar to that of Q05(a). The link between the temperature change and the speed/KE of the particles was very strong and the most common mark awarded. Again, only candidates working beyond Grade 7 gained the second and third marking points. However, some candidates did not make it clear that the rate of collisions decreased.

(b) The balloons were tested in a cold room on Earth so that the temperature of the gas was the same as on Mars.

(i) Explain why the pressure of the gas decreases if the temperature of the gas decreases.

(3)

as the temperature decreased the energy available in the atmosphere to the molecules was lower reducing the kinetic energy in the molecules reducing movement and collisions decreasing pressure

ResultsPlus
Examiner Comments

This response scored 1 mark for the clear link between the change in temperature and the kinetic energy of the molecules. No further marking points are seen.

(b) The balloons were tested in a cold room on Earth so that the temperature of the gas was the same as on Mars.

(i) Explain why the pressure of the gas decreases if the temperature of the gas decreases.

(3)

As the temprature decreases the kinetic energy of the molecule decreases so they do not move as fast and bounce off the walls of the container less frequently so the amount of force exerted reduces and pressure decreases.

ResultsPlus
Examiner Comments

An excellent response, typical of a candidate working at Grade 9. This response scored full marks.

Question 5 (b)(ii)-(iii)

There were few issues with selecting the correct formula in Q05(b)(ii). However, some candidates had difficulties with the use of the formula in Q05(b)(iii), most usually rearranging it. Some candidates mistook the units of m^2 and did 11^2 in the calculation.

Question 6 (a)

It was surprising to see that few candidates knew the name of the process that releases energy from hydrogen in stars. Alongside obviously incorrect answers, many candidates gave answers of fission. In addition, the answer of fusion was also not allowed due to its confusion with fission.

Question 6 (b)

This question was answered to a good standard by those candidates who had been taught or revised this part of the specification. However, more than half of all candidates scored no marks for either no response or a collection of irrelevant statements about the evolution. Those candidates who did score marks could articulate the main stages. Where candidates lost marks, it was usually for mentioning parts of the evolution of higher mass stars and therefore many candidates lost one mark due to this.

(b) Describe the evolution of the Sun from the start of its life to the end of its life.

(4)

first there will be so many stars in the same thing so after that they burst and the stars fly over then slowly it will be medium sized then they will become the red giant and then it will become the white dwarf. then later on it will be black dwarf

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Examiner Comments

This response scored 2 marks for the mention of the red giant (in the correct order) and white dwarf stages.

(b) Describe the evolution of the Sun from the start of its life to the end of its life.

(4)

The dust and gas particles ~~at~~ come together to form the nebula and ~~they~~ then they later compress a little more harder to form the main sequence star and the later the red giant then the white dwarf and later the black dwarf but if the ~~c~~ object is much more bigger instead of the red giant it forms a super red giant then explodes and turns into a black whole.

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Examiner Comments

This response scored 3 marks. Despite enough stages being included to score full marks, the inclusion of incorrect stages limited the maximum mark that could be awarded.

ResultsPlus
Examiner Tip

Candidates should read questions carefully to ensure their answers are focused and do not include irrelevant physics that may detract from their answer.

(b) Describe the evolution of the Sun from the start of its life to the end of its life.

(4)

Firstly, a nebula is formed. This, then turns into a protostar. This protostar forms into a main sequence star. The main sequence star forms into a red giant. This red giant will eventually form into a white dwarf.

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Examiner Comments

This concise answer includes all the relevant stages of evolution and was awarded 4 marks.

Question 6 (c)

Candidates found this question very challenging. Many candidates discussed collecting data only from the Sun, rather than for a range of different stars. The idea of verifying a formula through the calculation of a consistent constant appeared to be an unknown concept for most candidates.

(c) A star's colour is related to the peak wavelength of the light it emits.

A student claims that the peak wavelength is related to a star's surface temperature using the formula

$$\text{peak wavelength} \times \text{surface temperature} = \text{constant}$$

Describe how a student could use data to test the validity of this formula.

(2)

The student could collect data of the surface temperature and peak wavelength of the light emitted by a ~~few~~ few ~~planets~~ stars ~~in the solar~~ and apply the data to this formula by multiplying the wavelength by the surface temperature and checking if the answer is a constant in all the stars.

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Examiner Comments

This response scored 2 marks. The candidate clearly states to use the formula for more than one star and then to compare the constants calculated.

Question 7 (a)

Candidates found Q07(a)(i) surprisingly challenging despite the correct formula being given in the question itself. Many candidates did not use any value for g in their calculation and simply multiplied the mass and height change together to get an answer of 119.7, which was awarded no marks. Some candidates thought that the units of mass needed to be changed from kilograms to grams and these candidates lost a mark. The link between kinetic energy and gravitational potential energy eluded most candidates in Q07(a)(ii) and most thought an additional calculation was needed.

7 A helicopter is stationary above the ground.

A bag of sand is dropped from the helicopter.

(a) (i) The bag falls 6.3 m.

The mass of the bag is 19 kg.

Calculate the gravitational potential energy (GPE) change for the bag.

[GPE change = mass × gravitational field strength × height change]

(2)

GPE = m × g × h

= 19 × 10 × 6.3

= 1197 J //

GPE change = ...1197........ J

(ii) State the kinetic energy (KE) gained by the bag after falling 6.3 m.

You can ignore the effects of air resistance.

(1)

KE = GPE

KE = 1197 J

KE gained = ...1197........ J

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Examiner Comments

This response scored full marks. The candidate has shown their working clearly and arrived at the correct answers for both parts of the question.

Question 7 (b)

Most candidates did not know how to calculate the air resistance in this question. The statement that air resistance is equal to weight and the required link to the formula for weight seemed to be a step too far for most candidates.

Question 7 (c)

Candidates found this closed response style question surprisingly challenging. Approximately a third of all candidates scored marks of 0, 1 and 2, but a score of 3 marks was rarely seen.

Question 8 (a)

Candidates' answers varied in this question but almost half of all candidates were able to score at least one mark, usually for two magnets with opposite poles facing. Some candidates gave incorrect methods, possibly due to trying to incorporate the full equipment list into the answer – references to magnets being connected to power supplies were frequent.

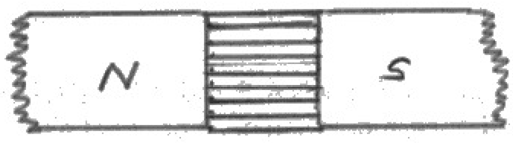
8 A student uses this equipment to investigate the force on a current-carrying wire in a uniform magnetic field.

- two permanent bar magnets
- straight length of wire
- connecting leads
- power supply

(a) Describe how to use two permanent bar magnets to form a uniform magnetic field.

You may draw a diagram to help your answer.

(2)



The only thing the student needs to do is keep the opposite sides of two bar magnets close to each other.

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Examiner Comments

This response scored 2 marks. The diagram clearly shows two magnets with opposite poles facing for the first mark. The idea of the magnets being close together is expressed in the written part of the response.

Question 8 (b)(i)

A mixture of arrows, quite often along the wire, were seen in this question. However, this may have been just an annotation to help them work out the answer. Those candidates who drew arrows that weren't along the wire were generally clearly aware of some force up or down, and approximately a quarter of all candidates correctly chose an upwards force.

Question 8 (b)(ii)

Candidates found this question very challenging and most responses yielded no marks. Some candidates communicated the idea of the wire having its own magnetic field (often expressed as an electromagnetic field), but the idea of this interacting with the other magnetic field was only communicated by the most able candidates.

(ii) Explain why a force is exerted on the current-carrying wire.

(2)

~~The force created by~~ The magnetic field created by the current carrying wire interacts with the permanent magnets feild and so a force is exerted.

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Examiner Comments

This response scored 2 marks. Both marking points are clearly seen in this well-expressed answer.

Paper Summary

Based on their performance on this paper, candidates should:

- Take note of the number of marks given for each question and use this as a guide as to the amount of detail expected in the answer.
- Take note of the command word used in each question to determine how the examiner expects the question to be answered, for example, whether to give a description or an explanation.
- Be able to rearrange the formulae listed in the specification.
- Know the SI units for physical quantities and be able to convert from non-SI units to SI units when required.
- Show all working, so that some credit can still be given for answers that are only partly correct.
- Take advantage of opportunities to draw labelled diagrams as well as, or instead of, written answers.

Grade boundaries

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