INTERNATIONAL GCSE

Physics (9-1)

EXEMPLARS WITH EXAMINER COMMENTARIES

PAPER 1

Pearson Edexcel International GCSE in Physics (4PH1)

Pearson Edexcel International GCSE in Science (Double Award) (4SD0)

Contents

Introduction

1.1 About this booklet

This booklet has been produced to support teachers delivering the Pearson Edexcel International GCSE in Physics specification. The Paper 1 exemplar materials will enable teachers to guide their students in the application of knowledge and skills required to successfully complete this course. The booklet looks at questions 4(b), 6(a)(i), 6(a)(ii), 8(a)(i), 8(a)(ii), 10(a), 12(a) and 12(b) from the June 2019 examination series, showing real candidate responses to questions and how examiners have applied the mark schemes to demonstrate how student responses should be marked.

1.2 How to use this booklet

Each example covered in this booklet contains:

- Question
- Mark scheme
- Exemplar responses for the selected question
- Example of the marker grading decision based on the mark scheme, accompanied by examiner commentary including the rationale for the decision and where relevant, guidance on how the answer can be improved to earn more marks.

The examples highlight the achievement of the assessment objectives at lower to higher levels of candidate responses.

Centres should use this content to support their internal assessment of students and incorporate examination skills into the delivery of the specification.

1.3 Further support

A range of materials is available from the Pearson qualifications website to support you in planning and delivering this specification.

Centres may find it beneficial to review this document in conjunction with: the specification, sample assessment materials, Getting Started Guide and the Principal Examiner's Report.

Question 4(b)

(b) The speed of the car affects the thinking distance and the braking distance.

Discuss other factors that affect the thinking distance and the braking distance of the car.

(4)

Mark scheme

(b)	max. two factors linked to thinking distance: MP1. tiredness (of driver); MP2. age (of driver); MP3. alcohol or drug consumption; MP4. distraction (of driver); max. two factors linked to braking distance: MP5. mass / weight of car; MP6. condition of brakes; MP7. condition of road; MP8. condition of tyres; MP9. slope of road;	allow 'reaction time' if no other thinking distance mark achieved ignore factors affecting visibility e.g. caffeine, medicine etc. e.g. using a mobile phone etc. ignore bald "the weather" allow however expressed e.g. more people, less luggage etc. e.g. icy road, wet road e.g. how much grip left / eq e.g. whether the car is going up or downhill	4

Exemplar response A

Another factor that affects the braking distane of the car is how good the brakes are. If the brakes are not as good, then the braking distance will be further and if the brakes are better, then the braking distance will be shorter. one other factor that affects the thinking distance is whether they are drunk or not. If they are drunk their reaction time will be slower making the thinking distance longer.

Examiner's comments:

This response was given 2 marks.

The command word ***discuss*** is used when candidates are expected to explore all aspects of a problem in their response and, therefore, they were expected to identify factors that would affect both the thinking distance **and** braking distance of the car. This response identified one factor that would affect the thinking distance (whether the driver has drunk alcohol) and one factor that would affect the braking distance (the quality of the car's brakes). The candidate has misinterpreted the demand of the question by explaining how each of the given factors affects the thinking distance or braking distance. The response could have been improved by identifying additional factors.

Exemplar response B

Thinking distance depends on several factors, whether the driver ~~or~~ is tired or under the influence of ~~drugs +~~ alcohol or other drugs that slows reaction times. Poor visibility may also make it difficult for the driver to identify the hazard. Braking distance depends on the condition of the tyres (should have good thread), condition of the road (dryness maximises friction) and it also depends on the mass/weight of the car.

Examiner's comments:

This response was given 4 marks.

This response has explored the question to a greater extent to gain all 4 marks. The candidate has identified two factors that affect the thinking distance:

- whether the driver is tired (MP1)
- whether the driver is under the influence of alcohol or drugs (MP3).

The candidate has identified a total of three factors that affect the braking distance:

- the condition of the tyres (MP8)
- the condition of the road (MP7)
- the mass of the car (MP5).

Candidates are expected to correctly link each given factor to either the thinking distance or braking distance to award each mark. This is clearly communicated in this response.

Question 6(a)(i)

6 (a) (i) A student investigates how current varies with voltage for a metal filament lamp.

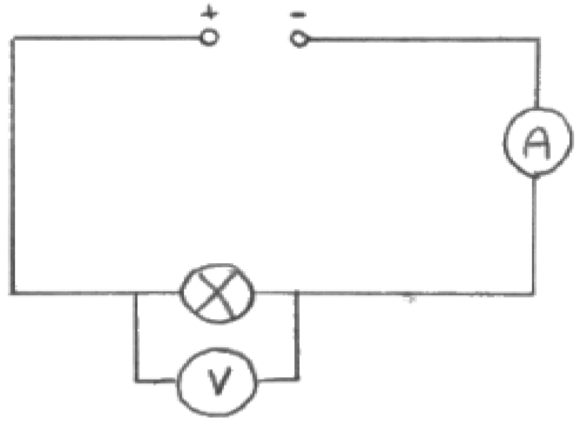
Draw a diagram of the circuit that a student could use for this investigation.

(4)

Mark scheme

Question number	Answer	Notes	Marks
6 (a) (i)	circuit with symbols for ammeter, voltmeter, lamp, any power supply all correct; voltmeter in parallel with lamp; ammeter in series with lamp; correct means of varying voltage of lamp i.e. variable power supply/rheostat/potentiometer;	variable power supplies or variable number of cells can be shown using labelled standard symbols if no lamp in circuit, allow ammeter drawn in series with power supply allow variable resistor in series with lamp	4

Exemplar response A

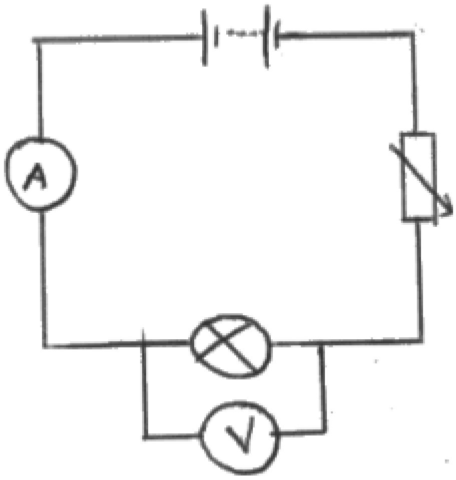


Examiner's comments:

This response was given 3 marks.

This response shows a suitable circuit for measuring both the current and voltage for a filament lamp. The ammeter and voltmeter are both connected correctly to the lamp and there is a suitable power supply to complete the circuit. The response is limited to 3 marks because it does not include any mechanism for varying the current in the lamp. Candidates are expected to be able to draw circuit diagrams for this standard investigation. If this response had included a diagonal arrow through the power supply symbol (thereby showing it as a variable power supply), then this would have been sufficient to score the 4th mark.

Exemplar response B



Examiner's comments:

This response was given 4 marks.

This response was awarded full marks as the candidate answered the question fully by including a mechanism for varying the current – a variable resistor. The rest of the circuit diagram was carefully drawn with a ruler and shows all the other essential components connected together correctly.

Question 6(a)(ii)

6 (a) (i) A student investigates how current varies with voltage for a metal filament lamp.

(ii) Describe a method the student could use for their investigation.

(4)

Mark scheme

(ii)	any four from: MP1. record ammeter and voltmeter reading; MP2. repeat readings (for each voltage) and find average; MP3. idea of changing the voltage / current; MP4. plot a graph of voltage and current; MP5. switch off current/circuit between readings;	allow 'measure voltage and current' allow repeating experiment to find average allow described method that would change voltage or current e.g. adding more cells, changing circuit resistance etc. ignore "let lamp cool between readings"	4

Exemplar response A

Measure the voltage of the bulb using a voltmeter at a given tim e.
Measure the current of the bulb by using a ammeter at a give tim e.
Use a stop watch to measure the time.
Repeat the experiment.
Plot the results on a graph.
Ignore anamalous points.

Examiner's comments:

This response was given 1 mark.

This response started well but crucial details were missing. It was awarded MP1 for the idea of measuring the voltage and the current but the idea of changing the voltage or current has not been communicated. Credit is not given for simply stating to repeat the experiment in a method and this response could be improved further by including the idea of finding the mean with the repeated results. The response has not been awarded MP4, despite knowing to plot a graph, because it did not state which variables should be plotted on the graph axes. The response could be further improved by including this detail, which could be shown on a simple diagram.

Exemplar response B

Turn the variable resistor to its maximum value. Close the switch and take the readings from the ammeter and voltmeter. Alter the value of the variable resistor again and take a new pairs of reading from the ammeter and voltmeter. Repeat this method for around five values of current. Organise the results in a table and plot a graph of current against voltage (I-V) graph.

Examiner's comments:

This response was given 3 marks.

This response is more focused and typical of candidates working at Grade 7 or above. The response was awarded MP1 for taking readings from the ammeter and voltmeter and MP3 for varying the value of the variable resistor (which would change the current in the circuit). The response was also awarded for specifically stating to plot a graph of current against voltage. The response could have been improved further by including the idea of repeating their experiment to obtain a set of mean values. The best responses also included the idea of switching off the circuit in between readings, which is recommended as good practice when conducting this investigation.

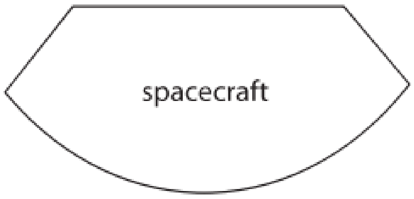
Question 8(a)(i)

8 Schiaparelli is a spacecraft that was sent to Mars in 2016.

(a) Schiaparelli slowed down as it fell vertically through the atmosphere of Mars.

(i) Draw labelled arrows on the diagram to show the forces acting on Schiaparelli as it fell.

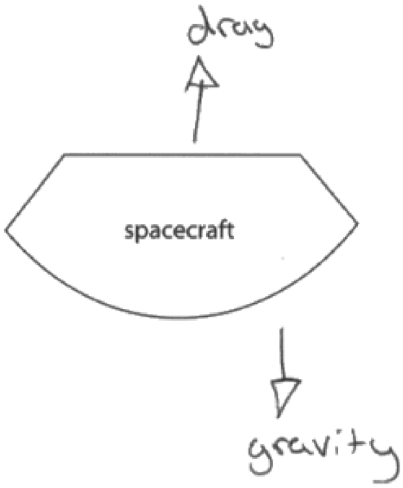
(3)



Mark scheme

Question number	Answer	Notes	Marks
8 (a) (i)	downward force arrow labelled "weight"; upward force arrow labelled "drag" / "air resistance"; upward force larger than downward force by eye;	ignore starting position of arrows and any horizontal arrows allow "gravitational force", "gravitational pull", "force of gravity" reject "gravity" allow "friction" ignore "upthrust"	3

Exemplar response A

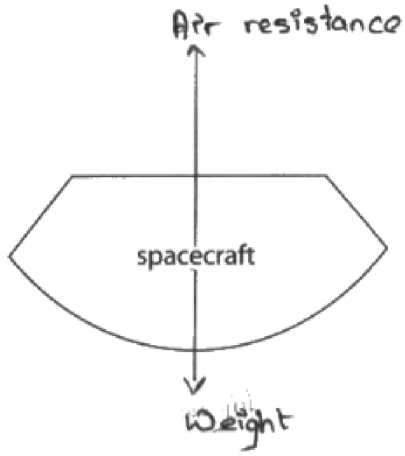


Examiner's comments:

This response was given 1 mark.

This response was awarded a mark for a correctly labelled upwards arrow but has not gained any other marks. It is important to note that labelling a downward force as "gravity" will not be given credit as the correct name of this force is "weight". This response could be further improved by drawing the force arrows more carefully. Candidates often overlook the length of their force arrows and do not appreciate that the length indicates the magnitude of the force. The upwards arrow is expected to be drawn longer than the downwards arrow to show that the spacecraft is slowing down as it falls.

Exemplar response B



Examiner's comments:

This response was given 3 marks.

Both force arrows have been drawn carefully to ensure they show that the upwards force of air resistance is larger than the downwards force of weight. Both forces have also been given the correct names. Candidates working at Grade 7 and above are usually capable of scoring full marks in this question.

Question 8(a)(ii)

(ii) Schiaparelli then opened a parachute to slow down.

Explain how the spacecraft reached a low terminal velocity after opening its parachute.

Use ideas about forces in your answer.

(4)

Mark scheme

(ii)	any four from:		allow "drag" for air resistance throughout condone "gravity" for weight throughout	4
	MP1.	air resistance increases (greatly) when parachute is opened;	allow "upwards force" for air resistance	
	MP2.	idea that air resistance is greater than weight;	allow upward force is bigger than downward force	
	MP3.	(therefore) resultant force is upwards;	allow deceleration / upwards acceleration ignore "it slows down"	
	MP4.	idea that as speed decreases, air resistance decreases;		
	MP5.	resultant force (eventually) becomes zero;	allow forces are balanced/equal air resistance = weight	
	MP6.	constant speed achieved;	allow idea that there is no acceleration	

Exemplar response A

When the schiaparelli opened the parachute
the air resistance acts upwards and Weight
force acts downwards. At a point both the
upward force (air resistance) and the downword
force called weight forces becomes equal and the
acceleration is zero and ~~z~~ moves at a constant speed
called the ~~termed~~ terminal velocity. In Mars gravitational
field strength is low.

Examiner's comments:

This response was given 2 marks.

Candidates working at Grade 4/5 usually achieved 2 or more marks in this question. This response gives a clear explanation, in terms of forces, about what happens when an object falls at its terminal velocity. It was awarded MP5 for the idea that air resistance and weight are balanced and MP6 for the idea that there is no acceleration at terminal velocity. However, the response did not explain the processes before terminal velocity is reached. Candidates at this level could generally produce well-learned explanations of terminal velocity but could not interpret this specific context well enough to explain how opening the parachute affected the forces acting on the falling spacecraft.

Exemplar response B

After the parachute was opened the terminal velocity decreased. This ~~at~~ was because the parachute increased air resistance ~~th~~ The air resistance may have been greater than the weight of the ~~air resistance~~ spacecraft at that point. So when the air resistance finally becomes equal to weight the terminal velocity will be lower

Examiner's comments:

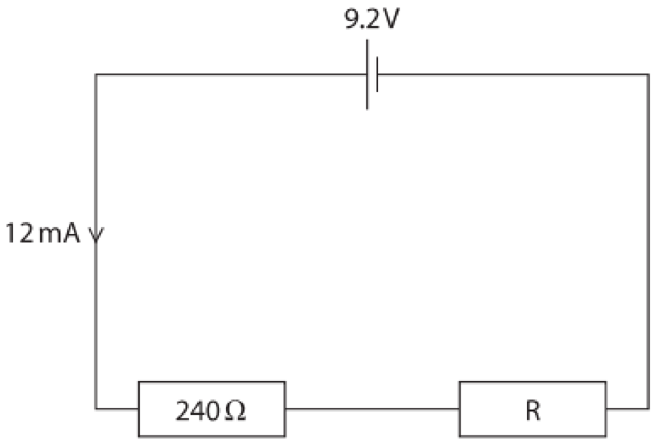
This response was given 3 marks.

This response demonstrates the typical level of understanding shown by candidates working at Grade 7 and above. It was awarded MP1 for identifying that the air resistance force increases when the parachute is opened, MP2 for recognising that this makes air resistance greater than the force of weight and MP5 for communicating that (eventually) the forces become balanced. The response could be further improved by adding additional details. For example, it could include the idea that an upwards resultant force acts on the spacecraft (when the parachute is opened) or that the force of air resistance decreases as the spacecraft slows down. The most able candidates wrote comprehensive responses to this question with their ideas presented in a logical, causational order.

Question 10(a)

10 This question is about voltage and current.

(a) The diagram shows two resistors connected to a battery.



Calculate the voltage across resistor R.

(4)

Mark scheme

Question number	Answer	Notes	Marks
10 (a)	use of voltage = current × resistance; calculation of voltage across 240 ohm resistor (2.88 V); idea that voltages of two resistors in series adds up to supply voltage; evaluation of voltage across R; e.g. V = I × R V_{240} = (0.012 × 240 =) 2.88 (V) $V_R + V_{240}$ = 9.2 (V_R =) 6.3 (V)	allow rearrangements and standard symbols calculate total resistance of circuit (767 Ω) evaluation of resistance of R (527 Ω) evaluation of voltage across R (using V = IR) allow 2.9 (V) allow 9.2 - 2.88 or V + 2.88 = 9.2 allow 6.32 (V) if mA not converted to A and 2880 seen then award 2 marks max.	4

Exemplar response A

Calculate the voltage across resistor R.

(4)

$V = I \times R$

$V = ?$

$I = 12mA$

$R = 240\Omega$

$V = 0.012 \times 240$

$V = 2.88$

voltage = 2.88 V

Examiner's comments:

This response was given 2 marks.

This response correctly converted the current from milliamps to amps and used it to calculate a voltage using a suitable formula. However, it did not appreciate that this was only half the problem and have written this voltage value as the final answer. To improve on this, candidates should apply their knowledge of series circuits and subtract this voltage value from the voltage of the battery to determine the voltage across resistor R.

Candidates working at Grade 4 could normally get at least this far through this two-step calculation.

Exemplar response B

Calculate the voltage across resistor R.

(4)

$V = IR$

240 Ω resistor: $V = 0.012 \times 240$

$= 2.88$ V

'R' resistor: let voltage $= V_R$

$V_R + 2.88 = 9.2$

$V_R = 6.32$ V

voltage = 6.32 V

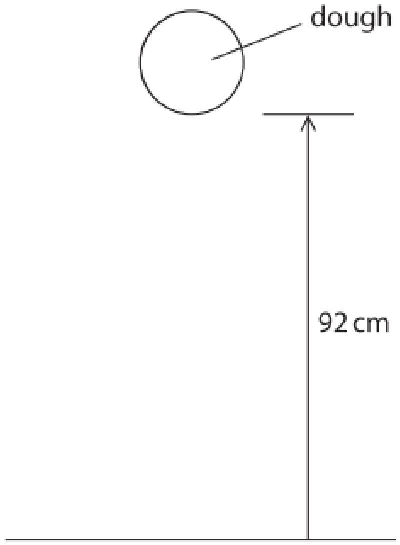
Examiner's comments:

This response was given 4 marks.

Candidates working at Grade 7 and above could usually complete this calculation to gain all 4 marks. This response correctly determined the voltage across the 240Ω resistor and then subtracted this from the battery's voltage to arrive at the correct final answer. It illustrates best practice in that the working is very clear and easy to follow. The candidate has written what they are doing at each stage and this ensures that the examiner can award method marks in the event that the candidate made a mistake.

Question 12(a)

12 (a) The diagram shows a ball of dough, of mass 580 g, held at a height of 92 cm above the floor.



Calculate the increase in gravitational potential energy (GPE) stored in the ball of dough when it is above the floor.

(3)

Mark scheme

Question number	Answer	Notes	Marks
12 (a)	substitution into GPE = mass × g × height; at least one quantity correctly converted to SI units; correct evaluation; e.g. GPE = 0.580 × 10 × 0.92 mass = 0.580 (kg) OR height = 0.92 (m) (GPE =) 5.3 (J)	allow substitution with no unit conversions allow g = 9.8, 9.81 allow 5.2, 5.34, 5.336, 5.23...	3

Exemplar response A

Calculate the increase in gravitational potential energy (GPE) stored in the ball of dough when it is above the floor.

(3)

GPE = mgh

= 580 x 10 x 92

GPE = 533 600 J

Examiner's comments:

This response was given 1 mark.

This question was challenging as it required candidates to know which formula to use and recall it from memory in addition to converting quantities into standard (SI) units. Grade 4 candidates usually knew which formula to use but did not attempt to convert any quantities into SI units - this response is a typical example of this level. The candidate has set their working out clearly and the examiner can confidently award 1 mark for a correct substitution into the correct formula. The work could be improved by converting either of (or both) mass and height into SI units. Candidates should be advised that almost all formulae in Physics require the use of SI units and that examination questions will often present data in non-SI units to assess this understanding.

Exemplar response B

Calculate the increase in gravitational potential energy (GPE) stored in the ball of dough when it is above the floor.

(3)

GPE = mgh

92 cm = 92×10^{-2} m

580 g = 0.58 kg

GPE = $0.58 \times 10 \times 92 \times 10^{-2}$

=

5.34 J

GPE = 5.34 J

Examiner's comments:

This response was given 3 marks.

Candidates working at Grade 7 and above usually knew to convert all quantities into SI units before substituting them into the correct formula. This response has clearly shown these conversions as the first step in the working, before writing the correct formula and substituting their values into it. The equation has then been appropriately evaluated to achieve the correct final answer. This response demonstrates best practice in terms of how to set out mathematical working in calculations.

Question 12(b)

(b) The ball of dough hits the floor and does not rebound.

Describe the energy transfers taking place from when the dough is dropped to after it has hit the floor.

You should refer to energy stores as well as transfers between energy stores at these stages.

- before the dough is dropped
- just before the dough hits the floor
- after the dough has hit the floor

(4)

Mark scheme

(b)	any four from: MP1. mention of energy being transferred <u>mechanically</u> at any stage in the response; MP2. (before it is dropped) dough initially has energy in its gravitational store (and no energy in its kinetic store); MP3. (just before it hits the floor) energy is in the dough's kinetic store (and less energy in its gravitational store); MP4. (as the dough falls / after the dough has hit the floor) the thermal store **of the air / floor / surroundings** has increased; MP5. (after the dough has hit the floor) the thermal/elastic store **of the dough** has increased (and the kinetic store of the dough is zero); MP6. energy has been transferred to the surroundings (mechanically and) by radiation;	 condone the ball initially having GPE condone energy transferred to KE condone energy transferred to heat energy of the surroundings ignore references to sound energy condone energy transferred to elastic/heat energy of the dough	4

Exemplar response A

Before the dough is dropped it has a gravitational potential energy (GPE) as the ball of dough is raised. GPE is only stored on raised objects. And GPE is maximum, kinetic energy is 0. As the ball of dough hits the ground GPE=0 Kinetic energy is maximum. After the ball of dough hits the ground ~~#~~ it's transffered to ~~Sound and heat energy~~ kinetic energy then to heat and Sound energy.

Examiner's comments:

This response was given 2 marks.

This response scored MP2 for the clear idea that the ball of dough has energy in its gravitational store before it falls. It also scores MP3 as the candidate has clearly communicated that the dough will have energy in its kinetic store just before it hits the ground. The candidate has attempted to describe some of the energy transfers after the dough hits the ground but has not been specific enough to gain further credit. The response could be improved by describing where the heat energy has been transferred to (the dough and the surroundings). In addition, the reference to sound energy was not credited, but if the candidate had described the energy as being transferred *by radiation* to the surroundings, they would have gained MP6.

Exemplar response B

Before the dough is dropped it only has GPE and no kinetic energy. As the ball of dough falls, its GPE is transferred into kinetic energy. Just before the dough hits the floor, it has ~~maximum kinetic~~ the maximum amount of kinetic energy. After the dough has hit the floor, the kinetic energy is transferred to the floor and also to the surroundings in the form of thermal energy and sound energy.

Examiner's comments:

This response was given 3 marks.

This response was awarded MP1 and MP2 for the correct references to energy in the gravitational and kinetic stores before the dough is dropped and just before it hits the ground. The response was also awarded MP4 for the clear idea that energy has been transferred to the thermal store of the surroundings. Candidates working at Grade 7 and above could usually score at least 3 marks in this question.

The response could be improved further by describing some of the methods of how energy is being transferred between stores. For example, describing the energy being transferred *mechanically* from the gravitational store to the kinetic store and the energy being transferred *by radiation* from the thermal store of the dough to the thermal store of the surroundings.

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