

Physics Challenge 2008 - Markscheme

Please award marks as indicated below. Equivalent valid reasoning should gain equal credit to the solutions presented here. Error carried forward marks may be awarded where an incorrect answer is used as part of the data needed for a subsequent question, providing that the resulting answer is not plainly ridiculous.

If incorrect units are used more than once then one mark should be deducted from the total.

If an inappropriate number of significant figures are given more than once in final answers then one mark should be deducted from the total.

Section 1 – Multiple Choice Questions

1	2	3	4	5	6	7	8	9	10
A	B	D	B	C	E	A	A	B	D

Section 2 – Short Answer Questions

Marks for these two questions should be awarded for a clear explanation of the underlying Physical principals using correct scientific terminology. Answers that are incomplete, contain errors in Physics or use terminology incorrectly cannot be awarded full credit.

Award 0 marks: No valid attempt made to answer question

Award 1 mark: Valid point presented but other-wise incorrect or incomplete answer

Award 2 marks: Partially correct answer but major error or omission in reasoning

Award 3 marks: Mostly correct answer, only minor errors or omissions in reasoning

Award 4 marks: Completely correct answer, no errors of reasoning or use of terminology

Question 11.

[4 max]

- student pushes down on floor
- reaction force from floor acting on student increases
- there is now a resultant force acting on the student (as reaction force from floor is greater than the weight of the student)
- resultant force acting on the student causes them to accelerate and so they leave the ground.

Question 12.

[4 max]

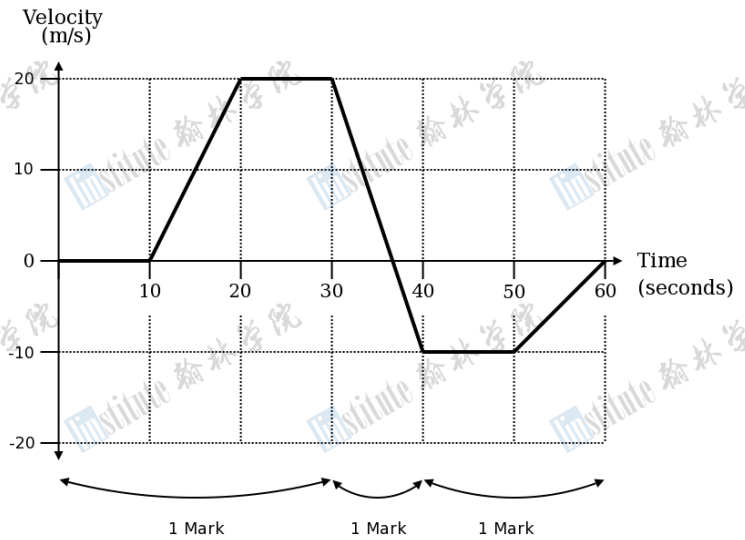
- light bulbs transfer electrical energy to other forms of energy
- therefore (more) mechanical energy must be transferred to electrical energy in generator
- for (more) mechanical energy to be transferred (more) work must be done on the handle
- more work done means a greater force is required and so harder to turn handle
(Alternative but equally acceptable answers might be expressed in terms of Lenz's law etc)

Section 3 – Longer Questions

Question 13.

(a)

- Correct scale [1]
- Initial Section showing positive relative velocity [1]
- Section from 30s showing change from positive to negative relative velocity [1]
- Final section showing negative relative velocity [1]



(b)

- Displacement (do not accept distance) [1]
- of one car from the other (owtte) [1]

(c)

- Calculation of area under (their) graph or calculation of displacement using appropriate equations of motion – award partial credit of up to 3 marks for any correct working even though final answer is incorrect. [3]
- 200 m [1]
(award full marks (4) for correct answer without working)

Question 14.

(a)

- Does not conduct in reverse bias [1]
- Does not conduct in forward bias for $V < 0.6\text{V}$ [1]
- Conducts in forward bias when $V > 0.6\text{V}$ [1]

(b)(i)

- Diode and resistor in series [1]
- Second resistor in parallel with series pair [1]

(b)(ii)

- Series resistor = 60Ω [1]
- Parallel resistor = 120Ω [1]

(c)(i)

- Symmetrical about origin [1]
- With positive gradient [1]
- Gradient increases as voltage increases [1]

(c)(ii)

- As current increases temperature increases [1]
- So resistance decreases (and gradient of graph changes) [1]

(c)(iii)

- Reduced resistance allows more current to flow [1]
- which in turn causes more heating and thermal runaway can occur (owtte) [1]

Question 15.

(a)(i)

- Graphical method attempted (OR calculation attempted) [1]
- Giving 3.5 cm to 4.5 cm (OR By calculation giving 3.9 cm) [2]
(Graphical method giving 3cm to 5cm allow 1 mark)

(a)(ii)

- Any attempt to use path difference from (a)(i) [1]
- To give wavelength = twice answer given in (a)(i) above [1]
(award both marks for correct answer without working)

(a)(iii)

- use of $c = f \lambda$ [1]
- $\lambda = 7 \text{ cm to } 9 \text{ cm}$ gives $f = 4.3 \text{ GHz to } 3.3 \text{ GHz}$ [1]
OR $\lambda = 7.8 \text{ cm}$ gives $f = 3.8 \text{ GHz}$

(b)

- Any ONE reasonable answer such as: not coherent / don't transmit [1]
continuously / don't use same frequency / amplitude different / wrong
wavelength