

# IGCSE PHYSICS 4420, NOVEMBER 2005 MARK SCHEME

---

## Paper 2H

### Question 1

- (a) longitudinal 1
- (b) use and recall  $v = f \times \lambda$  1
- 384 x 0.86 = 330 (m/s) 1
- (c) no 1
- (i) not within (audible) range frequency too high
- (ii) of 20 - 20 000 Hz 1

Total 5 marks

### Question 2

- (a) insulator zero if both boxes ticked for one row 1
- insulator 1
- (b) 1 mark each for **any two**
- (electrons) move from the cloth
  - to the rod
  - electrons are negative(ly charged) Maximum 2
- (c) to the rod / right 1
- (i) positive / similar charges repel
- (ii) or
- opposite / unlike charges attract 1

Total 6 marks

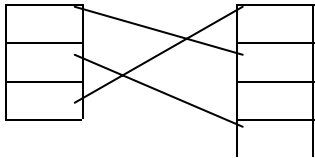
### Question 3

- (a) five correctly plotted points  $\pm$  half a small square
- 1 for each misplot or missing plot to a maximum of 2 2
- best straight line through 0,0 and at least one point on either side of the line 1

(b) 2.9 (cm)	2.8 - 3.0 cm read from graph $\pm$ half small square	1
(c) not linear relationship for large loads OWTTE	beyond elastic limit	1
(d) (helical)spring	allow (metal) wire	1
(i)		
(d) straight region indicates wire or spring (1)	any other reason why it might be spring/wire	
(ii)		
curved line would be seen for rubber band (1)	any reason why it isn't rubber band	
extension too great for wire (1)	reason why it isn't wire	
<i>not allowed if answered wire in(i)</i>		
	<b>Maximum</b>	<b>2</b>

**Total 8 marks**

**Question 4**

(a)		3
(b) none/zero		1
(i)		
(b) particle moving parallel to the field(lines)		1
(ii)		

**Total 5 marks**

**Question 5**

(a) light to		1
electrical		1
(b) 6000 / 120	6000 / 2 = 3000	1
(i) = 50(W)	scores 1	1
(b) 1 mark each for <b>any two</b>		
(ii)		
rays change angle of incidence at roof (1)		
clouds/weather conditions (1)		
no sun at night (1)		
	<b>Maximum</b>	<b>2</b>

**Total 6 marks**

### Question 6

- (a) reflection 1
- (b) draw reflected ray angles of incidence and reflection equal by eye 1
- draw second ray from cat tail reflected in mirror ditto 1
- drawn reflected rays converge at C 1

**Total 4 marks**

### Question 7

- (a) a.c. not 'cell is d.c.' 1
- 1
- (a) larger voltage 1
- 2
- (b) lamps in parallel with cell 1
- each lamp can be switched off/on independently 1

**Total 4 marks**

### Question 8

- (a) correct substitution once into (i)
- $$\text{density} = \frac{\text{mass}}{\text{volume}}$$
- copper 9 000 iron 8 000 1
- (a) iron 1
- (ii)
- (a) copper 1
- (iii)
- (b) measure length, (breadth, width) OWTTE 1
- with a rule 1
- multiply together or cube it 1

**Total 7 marks**

### Question 9

- |       |  |   |   |
|-------|--|---|---|
| (a)   | Y ... X ... Z                              | all correct in correct order                      | 1 |
| (i)   |  |   |   |
| (a)   | direction(s) shown                         | or (represented by) arrows                        | 1 |
| (ii)  |  |   |   |
| (a)   | (U=) X + Z - Y                             | or any order of +X, +Z and -Y                     | 1 |
| (iii) |  |   |   |
| (b)   | either 0.750 (3) m/s <sup>2</sup> east (1) | both unit and direction required for the 4th mark |   |
|       | or force = mass x acceleration (1)         | or 1125 = 1500 x acceleration                     |   |
|       | acceleration = force ÷ mass(1)             | or acceleration = 1125 ÷ 1500                     | 4 |

**Total 7 marks**

### Question 10

- |      |   |   |   |
|------|---|---|---|
| (a)  | electrical  | allow 'electricity'   | 1 |
| (b)  | reduce frequency  | allow 'lower/drop' frequency or increase wavelength   | 1 |
| (i)  |   |   |   |
| (b)  | increase amplitude  | allow 'raise' amplitude   | 1 |
| (ii) |   |   |   |
| (c)  | diffraction   | allow 'diffracted'  | 1 |
| (i)  |   |   |   |
| (c)  | ...(the width of the) gap...  |   | 1 |
| (ii) |   |   |   |
| (d)  | measure distance (1)  | if 'echo method' must be clear that this is the distance there and back   |   |
|      | start to measure time when sound generated (1)  | if 'observer method' must be clear how observer knows the moment sound generated  |   |
|      | one correct mention of appropriate measuring instrument i.e. metre rule/tape, stop watch/clock and no inappropriate mention (1) |   |   |
|      | indication that speed = distance ÷ time (1)   | points may be credited either from written response or from diagram but do not credit the point if writing and diagram contradict | 4 |

**Total 9 marks**

### Question 11

- |     |  |                      |   |
|-----|--|----------------------|---|
| (a) | either 6.75 (W) (2)                                      |                      |   |
|     | or power = current x voltage (1)                         | or power = 1.5 x 4.5 | 2 |
| (b) | either 4050 (J) (2)                                      |                      |   |
|     | or clear indication that time is 10 x 60 / = 600 (s) (1) |                      | 2 |

- (c) flow/movement of electrons (1)  
 from negative (end/side) to positive (end/side) (1) 2
- (d) any two, (1) each
- collisions between electrons and ions/atoms/nuclei/other particles do not credit 'molecules'
  - transfer of energy
  - (large) rise in temperature or gets (much) hotter
  - light /infra-red (radiation) given out 2

**Total 8 marks**

**Question 12**

- (a) either 50(.00) (3) (m/s) (1)  
 or  $KE = \frac{1}{2} mv^2$  (1) or  $KE = \frac{1}{2} \times 3.5(00) \times v^2$   
 $v^2 = 2 \times KE \div m$  (1) or  $v^2 = 2 \times 4375 \div 3.5(00)$   
or  $v^2 = 4375 \div 1.75(0)$   
or  $v^2 = 2500$   
or  $v = \sqrt{2500}$  4
- (b) **either** **treat parts (b)(i) and (b)(ii) together** 2
- (b) 4375 (J) (1)
- (i) any one of (1)
- (ii)
- conservation of energy applies allow 'no air (resistance)' 'no friction' 'no wind'
  - air resistance/friction negligible
  - stone does not hit anything (on the way down)
  - (energy transfer) 100 % efficient
  - no energy transferred (as it fell) as heat/sound do not credit 'no energy transferred when it landed'
  - zero gravitational/potential energy at ground level

or

(b) more than 4375 (J) (1)

(i)

(b) any one of (1)

(ii)

- (some) energy used to overcome friction/air resistance
- energy transfer is less than 100 % efficient
- (some) energy transferred (as it fell) as heat/sound
- some gravitational/potential energy at ground level

do not credit 'some energy transferred when it landed'

**Total 6 marks**

### Question 13

(a) appropriate statement (1)

examples of advantage

appropriate amplification/  
comment/ explanation (1)

no fuel is burned so no atmospheric  
pollution

nothing has to be transported to the  
site nor any waste disposed of

coal/oil/gas is not burned so does  
not increase the 'greenhouse'  
effect

do not credit '... cause the  
greenhouse effect ' for this 2nd  
mark

**2**

(b) appropriate statement (1)

examples of disadvantage

appropriate amplification/  
comment/ explanation (1)

wind not always strong enough /at  
appropriate strength so no  
electricity generated

wind (strength) may not match  
demand for electricity

visual/sound pollution so loss of  
(scenic) value/tourist potential

manufacture of the material to  
make the turbines results in  
pollution

**2**

**Total 4 marks**

### Question 14

- (a) any two, (1) each
- (i)
- fixed mass
  - temperature constant
  - (remains an) ideal gas
- 2
- (a) either  $0.58 \text{ (m}^3\text{)}$  (2) or  $0.576 \text{ (m}^3\text{)}$
- (ii)
- or (volume =)  
 $120 \times 1.2 \div 250$  (1)
- 2
- (b) 0/zero (K) 1
- (i)
- (b) the particles are not moving or lowest possible temperature 1
- (ii) or it is absolute zero
- (c) any three, (1) each
- heat conducted through the cylinder
  - (average/kelvin) temperature of the gas/particles increases
  - (average) speed of the particles increases
  - more (energetic) collisions with the (inside of) the cylinder
  - pressure increases
- 3

**Total 9 marks**

### Question 15

- (a) step-up transformer(s) used after **Either allow 'some increase and some decrease the voltage/current' for (1) mark only**
- (i) generation/at start of transmission
- (1)
- step-down transformer used after **or allow '(transformers used) at beginning and end' for (1) mark only**
- transmission/during distribution (1)
- 2
- (a) to increase voltage for transmission **points may be credited in either (a)(i) or (a)(ii)**
- (ii) (1)
- (so) energy losses are less/system more efficient/less energy lost as heat/transmission current is small
- (1)
- to decrease voltage to safe(r) value **or high voltage not appropriate for domestic equipment (1)**
- for use in homes etc. 3

(b)	either 15 (mA) (3)		
	or $V_p I_p = V_s I_s$ (1)	or $230 \times I_p (\div 1000) = 6 \times 575 (\div 1000)$	
	$I_p = V_s I_s \div V_p$ (1)	or $I_p (\div 1000) = 6 \times 575 (\div 1000) \div 230$	3

**Total 8 marks**

**Question 16**

(a)	to ensure that the current flows through all of the coil	or to prevent a short circuit do not credit references to electric shock or to heat insulation	1
(b)	to the right/inwards	allow 'towards the magnet'	
(i)		do not credit 'away from the cone'	1
(b)	any two, (1) each		
(ii)	<ul style="list-style-type: none"> <li>(use a) more powerful/stronger (permanent) magnet</li> <li>have more turns on the coil</li> <li>larger current</li> </ul>	allow 'have more coils on the coil' do not credit 'have a bigger coil' allow 'larger voltage'	2
(c)	3.6 (kHz)		1
(i)			
(c)	kilohertz	allow 'kiloHertz'	
(ii)		allow 'phonetic' spellings	1

**Total 6 marks**

**Question 17**

(a)	Isotopes (1)		
	protons ... neutrons (1)	both in the correct order	2
(b)	alpha/ $\alpha$		1
(i)			
(b)	helium nucleus/ ${}^4_2\text{He}$ is an alpha/ $\alpha$		
(ii)	particle		1
(c)	neutron/n		1
(i)			
(c)	fission	accept minor misspelling but not if it could be read as 'fusion'	1
(ii)			
(c)	nuclei (1)	accept 'nucleuses'	
(iii)	neutrons (1)		
	kinetic (1)	accept 'movement'	3



- (c) neutrons (given out) hit other nuclei (1)  
 (iv) uranium-235 (1)

Either must be a critical/sufficient mass (of uranium-235) (1)

or

which (in turn) release more (1) neutrons and so on

this mark should only be awarded if the notion is conveyed that the process continues

2

**Total 11 marks**

**Question 18**

- (a) horizontal line from the maximum to the y-axis

must be clear that terminal velocity is intercept on the y-axis

1

- (b) any six points, (1) each

- (object is) pulled down(wards) by (force of) gravity
- at the start the acceleration (downwards) is greatest
- so the slope (of the graph) is steep(est)
- the faster it falls the greater the (force of) friction/air resistance (becomes)
- so unbalanced/resultant force becomes less
- so the acceleration becomes less and the slope becomes gentler
- levels off when the unbalanced/resultant force becomes zero

both parts are now required for this mark

or levels off when friction/air resistance (upwards) = gravity/weight (downwards)

6

**Total 7 marks**

**Total for paper 120 marks**