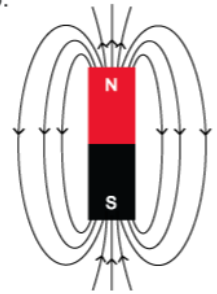
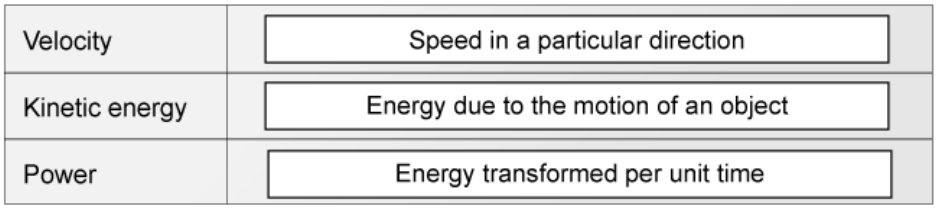
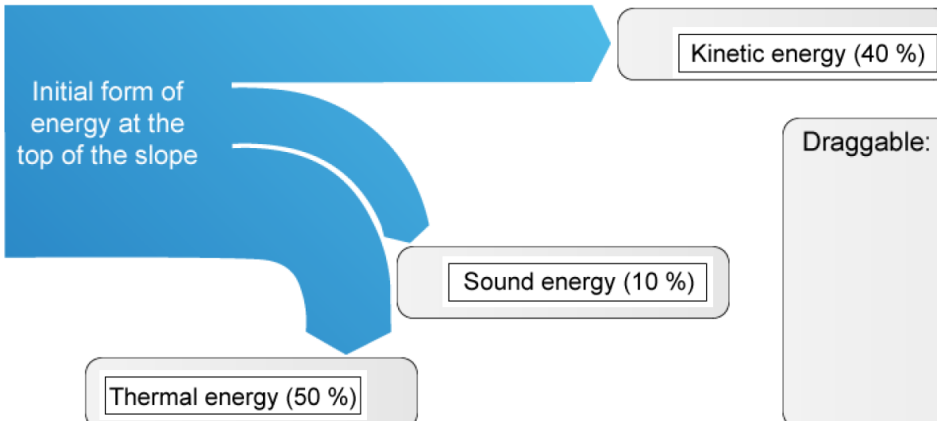
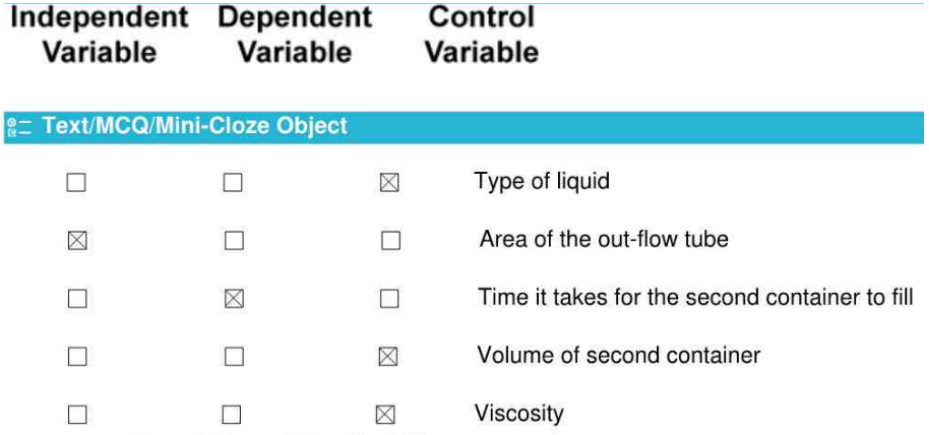
Question		Answers	Notes	Total	Criterion
1	a	B.  		1	A
	b	***Any two of the points below [max 2]*** • stronger magnet • faster movement of magnet • use a coil of wire with lower resistance • coils closer together	*Do **not** accept increase the number of turns as this is given in the question* *Accept area only if accompanied by discussion of flux density*	2	A
	c	current flows in the opposite direction		1	A
	d	evidence of use of transformer equation correctly calculated value of 220 (V)	*Award 2 marks for correct answer only* *Award 2 marks for 0V only if there is justification using direct current*	2	A
	e	power in both coils calculated (60 W, 57 W) efficiency correctly calculated as 95 % / 0.95	*Award 1 mark for correct answer with non-standard method*	2	A
	f	alternating current produces the change in magnetic field ***or*** direct current produces a change in the magnetic field only when it is switched on ***or*** off (this) produces an alternating current of current in the secondary coil A ***or*** a direct current would only produce an output current when switched on or off	*Accept continuous output of current*	2	A

2	**a**			**3**	A
	b	gravitational potential		**1**	A
	c	evidence of use of correct formula correct value of 26000 (J) 26 (kJ)	*Award 1 mark for 26 (kJ) if no calculation is seen* *Correct conversion of an incorrectly calculated number can score this mark*	**3**	A
	d	friction	*Do **not** accept air resistance alone*	**1**	A
	e			**1**	A

3	**a**	convection		**1**	A
	b	cold air goes down ***or*** hot air goes up hot air is less dense than cold air so it rises cooling is more effective (than if it was placed at the bottom)	*Do **not** accept heat alone, must be hot air ORA* *WTTE*	**3**	A
	c	high energy particles in the liquid escape the surface leaving lower energy particles behind link between kinetic energy and thermal energy ***or*** temperature	*Accept fast moving for high energy*	**3**	A
	d	silver ***or*** white ***or*** shiny ***or*** metallic ***and*** is best at reflecting sunlight answer includes a correct reference to (infra-red) radiation / waves	*ORA Ignore references to other colours* *Do **not** accept incorrectly named types of EM radiation*	**2**	A

4	**a**	How does the area of the hole affect the time it takes to fill a container?	*WTTE* *Do **not** accept time to empty*	**1**	B
	b	***Any simple prediction, for example*** as the hole gets bigger the time to fill the container will reduce ***Explanation contains relevant scientific knowledge*** (because) the larger the area of the hole the greater the amount of water flowing through it ***Any quantitative element agreeing with the prediction, for example*** as the area doubles the flow rate doubles	*ORA for size and time* *Accept equivalent <u>correct</u> relationships in terms of radius, diameter, circumference*	**3**	B
	c	 Correct identification of area as IV only Correct identification of time as DV only Type of liquid ***and*** volume ***and*** viscosity as CV		**3**	B
	d	***Any two suitable, for example [max 2]*** • stopwatch/timer/chronometer • device for measuring the size of the hole (ruler, calipers) • measuring cylinder		**2**	B

	e	measurements of <u>time</u> to fill a fixed volume ***and*** diameter/radius/area of hole at least five increments at least three repeated trials	*No ECF*	**3**	B
	f	title correctly linking IV and DV		**1**	C
	g	as area increases, the fill time decreases ***or*** as the inverse of area increases, the fill time increases (fill time is) inversely proportional (to area) ***or*** proportional to the inverse of area ***or*** linear relationship that goes through zero	*First mark is implicit in second marking point, award 2 marks*	**2**	C
	h	calculation using data from the graph constant correctly calculated = 15 (scm^2)	*Seen or implied* *unit not required*	**2**	C
	i	evidence of using $a = k/t$ answer correctly calculated 0.17 (cm^2)	*ECF from part (h)* *Accept answers in the range 0.16-0.18* *Do **not** accept answers given as a fraction*	**2**	C

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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Variables (V)</td><td>Time implied as dependent variable</td><td>Independent variable and dependent variable of time to fill container stated</td><td>Independent, dependent variable of time to fill container and one control variable stated and justified</td><td>Independent, dependent variable of time to fill container and two control variables are stated and justified</td></tr>
<tr><td>Equipment (E)</td><td>Some equipment is listed</td><td>Equipment to give a range of IV is listed</td><td>Named equipment for measuring volume and time</td><td></td></tr>
<tr><td>Method (M)</td><td>Attempt at a method linked to volume and time</td><td>The method is described and could be followed by another student</td><td>Complete method is described, fully explained and could easily be followed by another student</td><td></td></tr>
<tr><td>Data (D)</td><td>Reference to different increments or trials</td><td>At least five increments or three trials</td><td>At least five increments and three trials</td><td></td></tr>
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<td>13</td>
<td>B</td>
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<tr><td>6</td><td>a</td><td><u>12.8</u> (s)

s</td><td>Needs to be stated to this precision

Award this mark separately
Accept second(s) do not accept sec(s)</td><td>2</td><td>C

D</td></tr>
<tr><td></td><td>b</td><td><table><tr><th>Height of water / cm</th><th>Time taken to empty the tube / s</th></tr><tr><td>2</td><td>6.4</td></tr><tr><td>4</td><td>9.0</td></tr><tr><td>6</td><td>11.1</td></tr><tr><td>8</td><td>12.8</td></tr><tr><td>10</td><td>14.3</td></tr></table>
both labels correct: Time (to fill the container) and height (of liquid)

both units included in labels and not next to data values

all times and corresponding heights correctly recorded

data organized in ascending or descending order</td><td>

Ignore incorrect use of brackets around unit

ECF from part (a)</td><td>4</td><td>C</td></tr>
<tr><td></td><td>c</td><td>A. ◉

  </td><td></td><td>1</td><td>C</td></tr>
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	d	for the results to be proportional the line must go through (0,0) the line crosses the y axis at 5.0 so not proportional ***or*** for the results to be proportional the line must be straight a curve would fit the data better so cannot be proportional ***or*** if the quantities are proportional then doubling the height will double the time data used to demonstrate that this trend is not seen	*Accept values in the range 5.0±0.5*	**2**	C
	e	student D had the most valid method because the range of data most clearly shows the correct relationship the range of data of the other students is not wide enough to show the correct relationship ***or*** the range of data of the other students shows an incorrect linear relationship across the range selected	*WTTE*	**3**	C
	f	***Any relevant alternative independent variable, for example*** • liquid with a different viscosity • pressure • liquid with a different density • type of liquid	*Do **not** accept size of hole, volume of container, gravitational field strength*	**1**	C
	g	Any simple prediction linked to relevant IV Prediction links IV from part (f) to time taken to empty tube Attempts to link to scientific knowledge		**3**	C

7	**a**	increased (between 1975 to 2005) it was below world average before 1998 ***or*** it was above world average after 1998	 *Accept in the range 1997-1999*	**2**	D
	b	***Accept any reasonable answer, for example*** • increased industrialization • more people having domestic electricity • more electrical energy used in the home • increased use of technology	*Do **not** accept more people as the data refers to power consumption per person*	**1**	D
	c	first mark for data points (1.27±0.01, 3150±50) correct use of data to calculate 3.94 x 10^{12} (kWh)	 *Accept any value in range 3.9-4.1 x 10^{12}*	**2**	D
	d	***Accept any reasonable answer linked to the environment, for example [max 3]*** • named pollutant gases ***or*** CO_2 • smoke or particulate pollution • coal mining and destruction of habitat • contribution to climate change ***or*** rising sea levels ***or*** greenhouse effect • acid rain	*Do **not** accept "pollution","waste","burning fossil fuels" without further detail* *Accept more than one response in a single box*	**3**	D
	e	***Gravitational potential – kinetic energy – electrical energy*** three correct forms selected all in correct sequence		**2**	D

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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Impacts on the river (I)</td><td>A positive or negative impact on the river</td><td>A positive or negative impact on the river supported with information</td><td>A positive and negative impact on the river supported with information</td><td>A positive and negative impact on the river supported with information and linked to science</td></tr>
<tr><td>Wider landscape (W)</td><td>A positive or negative impact on the natural landscape</td><td>A positive or negative impact on the natural landscape supported with information</td><td>A positive and negative impact on the natural landscape supported with information</td><td>A positive and negative impact on the natural landscape supported with information and linked to science</td></tr>
<tr><td>Global persective related to CO_2 (G)</td><td>An attempt to identify an impact on a global scale</td><td>An impact on a global scale supported with information</td><td>An impact on a global scale supported with information and linked to science</td><td></td></tr>
<tr><td>Concluding appraisal (C)</td><td>A concluding statement</td><td>A concluding appraisal including positive and negative arguments</td><td>A concluding appraisal evaluating all arguments</td><td></td></tr>
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<td>14</td>
<td>D</td>
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