2018 MJC H2 Physics Prelim Exam Paper 2
Suggested solutions

1 (a) (i)

When the system oscillates without any external periodic force applied, its frequency is called its natural frequency.
Comments:
Considering it is a recall question, it is poorly attempted.
To get the mark, students are to mention that "it is the frequency when…."

(ii)

Resonance occurs when the frequency of the driving force (driving frequency) is equal to the natural frequency of the system, giving a maximum amplitude of vibration.
Comments:
Generally well done.
However a handful of students left out the effect of resonance which is giving maximum amplitude.

(b)

1) Microwave Cooking
In a microwave oven, microwaves with a frequency similar to the natural frequency of vibration of water molecules are used. When food containing water molecules is placed in the oven and radiated by microwave, the water molecules resonate, absorb energy from the microwaves and get heated up. This absorbed energy then spreads through the food and cooks it. The plastic or glass containers do not heat up as much since they do not contain water molecules.

2) Radio Receiver
Our air is filled with radio waves of many different frequencies which the aerial (antenna) picks up. The tuner can be adjusted so that the natural frequency of the electrical oscillations in the circuits is the same as that of the radio wave transmitted from a particular station (the desired station). The radio waves of that particular frequency cause much larger oscillations (due to resonance) resonance compared to the radio waves of other frequencies.

3) Magnetic resonance imaging
Strong, electromagnetic fields of varying radio frequencies are used to cause oscillations in atomic nuclei. When resonance occurs, energy is absorbed by the molecules. By analysing the pattern of energy absorption, a computer-generated image can be produced. The advantage of MRI scanner is that no ionising radiation (as in the process of producing X-ray images) is involved.

4) Swing
The swinging of the legs / the person pushing the swing has to be synchronised and at the same frequency as the natural frequency of the swing so that a large amplitude of oscillation can be obtained.

5) Musical instrument
Musical instruments are set into vibrational motion at their natural frequency when a person hits, strikes, strums, plucks the object. Each natural frequency of the object is associated with one of the many standing wave patterns by which that object could vibrate. The vibrations of the lips (brass instruments) / vibration of a wooden strip (woodwind instruments) against the mouthpiece matches one of the natural frequencies of the air column inside the brass instrument. This forces the air inside of the column into resonance vibrations.

(c)

1) Earthquakes and tidal waves
During an earthquake, when the frequencies of the vibration match with the natural frequencies of buildings, resonance may occur and result in serious damages. In regions of the world where earthquakes happen regularly, buildings may be built on foundations that absorb the energy of the shock waves. In this way, the vibrations are damped and the amplitude of the oscillations are lowered.

2) Vibrations in machines / metal panels
If a loose part in a car rattles when the car is travelling at a certain speed, it is likely that a resonant vibration is occurring. A washing machine with an unbalanced load which has natural frequency matching the spinning frequency will get violent vibrations as resonance occurs. Place dampers in the machine / place strengthening struts across the panel or change its shape/area of panel to lower the amplitudes.

3) Suspension bridge
Suspension bridge can collapse in strong winds. The strong wind (driving frequency) across the bridge forced it to sway at its natural frequency. The swaying increased greatly in amplitude, and the structure collapsed. Build dampers into the bridge help lower the amplitudes.

Comments for (b) & (c):
- While students were able to recall what is meant by resonance, from (b) and (c), it shows that students do not appreciate and understand resonance clearly.
- These 2 parts were very poorly attempted. Students answers did not have clarity and were vague. E.g. simply saying resonance will be reduced. Must clearly state how is it reduced, lower the amplitude.
- Many students mix up resonance and damping.
- Please note that changing natural frequency is NOT damping.

2 (a)(i)

$$f = \frac{1}{T} = \frac{1}{5.0 \times 10^{-3}} = 200 \text{ Hz}$$ [B1]

Comments:
Excellent!

(ii)

$$Intensity \propto \text{Amplitude}^2$$

$$\frac{I_2}{I_1} = \frac{A_2^{\,2}}{A_1^{\,2}}$$

$$\frac{I_2}{I} = \frac{\left(\frac{5A}{2}\right)^2}{A^2}$$ [M1]

$$I_2 = \frac{25}{4} I = 6.25\, I$$ [A1]

Comments:
Majority of students did well for this question.
A handful of students got the final answer but the presentation was incorrect. Proportionality sign is NOT the same as equal sign. With a proportionality relationship, use ratio method to solve or find the constant k first.

(b) (i)

The two waves must be coherent, (with constant phase difference between the two waves). [B1]
They must either be unpolarised, or polarised in the same plane. [B1]
Comments:
Generally well done.
Common mistakes:

- Many students wrote the condition where the 2 waves must have similar amplitudes, but this is not accepted as clearly from the question, the amplitudes are not similar.
- Significant number of students wrote “polarised or unpolarised in the same plane”, this is NOT the same. The polarised wave needs to be in a particular plane but not the unpolarised wave.

(ii)

If the source is in phase, their path difference must be equal to (n+½) wavelengths where n is an integer. [B1]
Or
The two waves must meet in antiphase with each other. [B1]
Comments:

- It is actually crucial to mention that the waves MEET in antiphase , but BOD was given even without the word ‘meet’.
- Students need to be aware that antiphase is a very specific term where it is π rad out of phase. So by simply writing the waves are out of phase is not good enough.

- For students who wrote the condition of path difference, most answers were incomplete either forgetting to include the initial condition of the source (in phase or antiphase) or did not specify what 'n' refers to.

(iii)

For minimum intensity, the resultant amplitude is $\frac{5A}{2}-A$ [M1]

$$\frac{I_{min}}{I}=\frac{\left(\frac{5A}{2}-A\right)^2}{A^2}$$

$$I_2=\frac{9}{4}I=2.25\,I \qquad \text{[A1]}$$

Comments:
Generally well done. Majority of the students know to first find the resultant amplitude before finding the resultant intensity.
Again, here students may have the final answer correct but had incorrect presentation.

3 (a)

	Stationary Wave	**Progressive Wave**
Wave profile	• Varies from one extreme position to another, but does not advance.	• Advances with the speed of the wave.
Energy of wave	• Energy is retained within the vibratory motion of the wave.	• Energy is transferred in the direction of wave propagation.
Amplitude of oscillation of individual particles	• Depends on position along the wave • Particles at the antinodes oscillate with maximum amplitude • Particles at the nodes do not oscillate	• Same for all particles in the wave regardless of position (assuming no energy loss).
Wavelength	• Twice the distance between 2 adjacent nodes/ antinodes. • Equal to the wavelength of the component waves.	• Distance between any 2 consecutive points on the wave with the same phase.
Phase of wave particles in a wavelength	• All particles between 2 adjacent nodes are in phase. • Particles in alternate segments are in anti-phase (have a phase difference of π).	• Wave particles have different phases (0 to 2π) within a wavelength.
Any 2 rows [B1, B1]		

Comments:
A purely recall question, yet students did not score for this question. Answers given were very vague and had many incorrect phrasing, where marks were not given.
Please avoid saying E.g: "Progressive wave….., but stationary wave *does not*", elaborate the characteristics of the stationary wave instead of simply saying it does not, this does not show the marker that the writer has any understanding.

(b) (i)

$$\tan\theta = \frac{38}{165}$$

$$\theta = 12.97° \ (13°)$$

$$d\sin\theta = n\lambda$$

$$d = \frac{632\times10^{-9}}{\sin 12.97°} = 2.82\times10^{-6} \qquad [M1]$$

$$\text{number of lines per metre} = \frac{1}{d} = \frac{1}{2.82\times10^{-6}} = 3.6\times10^{5} \qquad [A1]$$

Comments:
Generally well done.
- Most students are able to obtain the correct angle and then find *d*.
- Students who tried to find *n* instead, clearly do not understand the equation.
- Students who used the double slit equation (x = λD/a), no marks given.

(ii)

P remains in the same position [B1]
X and Y rotate through 90° [B1]
Comments:
Poorly done.
- Very carelessly, many students did not take note that Fig 3.1 is TOPVIEW, which means X & Y are on the right and left of P, hence after rotation, X & Y should be now above and below P.
- No marks awarded if students wrote P, X, Y no change.

(iii)

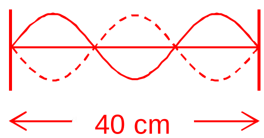
Screen is not parallel to the diffraction grating. [B1]
or
The diffraction grating is not normal to the incident light. [B1]
Comments:
A significant number of students wrote that the diffraction grating had unequal spacing. This is not accepted because the question mentioned that using the apparatus in (b)(i), where in (b)(i), the grating gave equal distance XP and PY, so using back this same grating cannot yield the unequal distance, it must be another factor causing it.

(c)

(i)

Only standing waves that have a wavelength that fits the boundary conditions are possible. [B1]
OR
Standing waves are formed only when the length AB is an integer multiple of half wavelengths. [B1]
Comments:
Very poorly done.
Many students mention that nodes must be formed at A and B but failed to link the nodes formed to frequency. It is necessary to mention this missing link which is only certain wavelengths can be formed based on this condition.

(ii)



3 loops / 3 segments

$$\frac{3}{2}\lambda = 40 \text{ cm}$$

$$\lambda = 26.7 \text{ cm} \qquad \text{[A1]}$$

Comments:
Excellent

(iii)

Stationary wave is formed by two oppositely moving waves of the same type and frequency. [B1]
This product is the speed of propagation of the individual wave that results in the stationary wave. [B1]
Comments:
This is a past year A level question.
Very poorly done. Students had no clue what this speed represents.

4 (a)

energy lost by metal = energy gained by water + energy gained by calorimeter

$$82.7(T-90) = \left(0.130 \times 4.2 \times 10^3\right)(90-25) + 54.6(90-25) \qquad \text{[M1]}$$

$$T = 562 \text{ }^\circ\text{C} \qquad \text{[A1]}$$

There is no heat loss when the metal was transferred from the flame to the water.
Or
Metal and flame have achieved thermal equilibrium.
Or
Mass of water constant.
Or
No heat loss by evaporation of water [B1]

Comments:
Poorly attempted.
A range of mistakes included

- Did not add energy gained by calorimeter
- Initial temperature of metal is 90 °C
- After taking 90°C – 25°C, students went on to add 273.15 to the subtracted answer. Please note: ΔT (°C) = ΔT (K)!!

For the assumption, many students simply wrote there is no heat loss to the surroundings. This is not accepted, it is vague, as the diagram showed lagging around the calorimeter which means there is no heat loss there.

(b)

Process	**Heat supplied to gas / J**	**Work done on gas / J**	**Increase in internal energy of gas / J** $\Delta U = Q + W$
A to B	0	300	300
B to C	2580	-740 $-p(\Delta V) = -1.6 \times 10^5 (4.6 \times 10^{-4})$	1840
C to D	0	-440	-440
D to A	-1700	0 $\Delta V = 0$	-1700

Each process (row) correct, award one mark.
Comments:
Surprisingly badly done.
Question stated process AB to CD has not heat exchange, this clearly indicates that Q = 0.
For process BC, many students wrote ΔU = 1844 J, this is an SF error. It should be ΔU = 1840 J, so that the $\Delta U_{total} = \Delta U_{AB} + \Delta U_{BC} + \Delta U_{CD} + \Delta U_{DA} = 0$

(c) .

Amount of energy required is greater at constant pressure. [A0]

For an ideal gas, internal energy is proportional to temperature. The change in internal energy Δ*U* is the same for both cases. [B1]

By first law of thermodynamics, the increase in internal energy, Δ*U* = heat supplied to the system, *Q* + work done on the system, *W*. [B1]

At constant volume, internal energy increases, but no work is done. ($Q = \Delta U$)
At constant pressure and with volume increase, internal energy increases and work is done by the gas ($Q = \Delta U - W_{on} = \Delta U - (-W_{by})$) [B1]

Comments:
Poorly attempted.
However, many students were able to identify the work done for both the conditions and were able to at least obtain 1 mark.
Things to note:

- Please make it a habit to explain the meaning of the symbols used in your answer!
- Do not simply quote "By first law of thermodynamics" without elaborating what this law is about.
- Failure to state that ΔU is the same for both conditions. Even if it was stated, there was no explanation as to why it must be the same (because for ideal gas, ΔU is proportional to T)

5 (a)

The magnetic flux through a plane surface is the product of the flux density normal to the surface and the area of the surface

Comments:
1. Many students missed out the key words "normal to the surface". Some wrote the definition of *magnetic flux density* instead.
2. Many students used the word perpendicular in place of *normal*. Note that *perpendicular* is usually used for 2D. Used normal for 3D.
3. No mark was granted if the answer seems to suggest that the area and B field must be normal to each other. Please memorise definitions. The meaning is often distorted when students try to rephrase definitions.

(b)

(i)

$$B = \mu_0 nI = 4\pi \times 10^{-7}\left(\frac{400}{1.6}\right)3.8 \qquad \text{[M1]}$$
$$= 3.8 \times 10^{-4}\pi$$

$$\Phi = NBA$$
$$= 80 \times \left(3.8 \times 10^{-4}\pi\right) \times \pi\left(\frac{0.040}{2}\right)^2 \qquad \text{[M1]}$$
$$= 1.2 \times 10^{-4}\ \text{Wb} \qquad \text{[A0]}$$

Comments:
1. Generally well done
2. Some students used n = 400, not realising that n refers to the number of turns per unit length.

3. No mark is awarded if B is calculated wrongly, even if students somehow got the correct value of Φ by dividing their answer by 1.6 (probably through reverse calculation).

(ii)

$$E_{mean} = \frac{\Delta\Phi}{\Delta t}$$

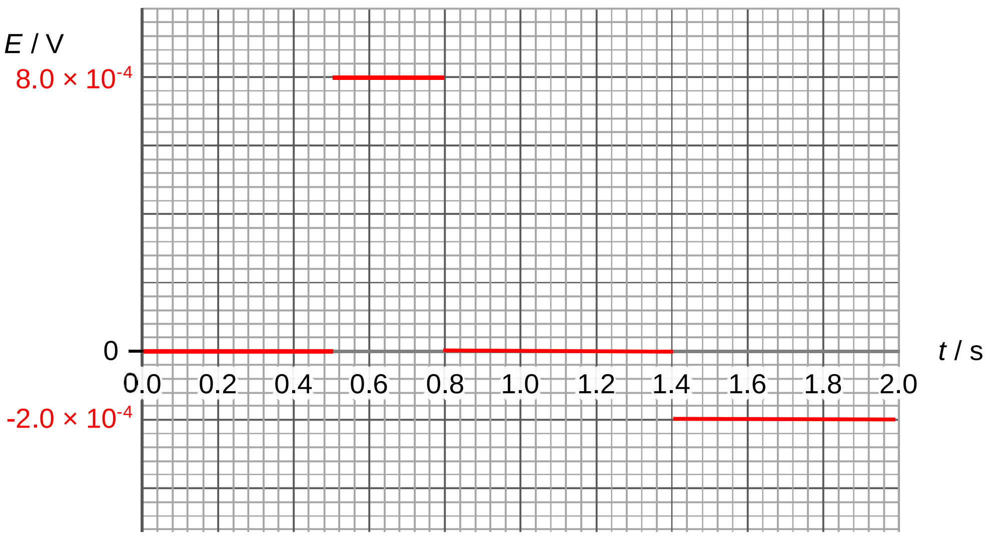
$$= \frac{2 \times 1.2 \times 10^{-4}}{0.30} \qquad \text{[M1]}$$

$$= 8.0 \times 10^{-4} \text{ V} \qquad \text{[A1]}$$

Comments:

1. Poorly done.
2. Majority of the cohort got 4.0×10^{-4} V as the answer. Note that when the current is <u>reversed</u>, flux linkage Φ goes from 1.2×10^{-4} Wb to -1.2×10^{-4} Wb. Magnitude of the change in Φ is hence $2 \times 1.2 \times 10^{-4}$ Wb

(iii)



$E_1 = 0$ V from $t = 0$ s to 0.3 s and 0.8 s to 1.4 s [B1]

$E_2 = 8.0 \times 10^{-4}$ V from $t = 0.3$ s to 0.8 s [B1]

$E_3 = 2.0 \times 10^{-4}$ V from $t = 1.4$ s to 2.0 s,

E_3 in reversed polarity of E_2, with magnitude of ¼ E_2 [B1]

$$\frac{\Delta y_3}{\Delta x_3} = \frac{0.5\Delta y_2}{2\Delta x_2} = \frac{1}{4}\frac{\Delta y_2}{\Delta x_2}$$

No label but ratio between E_2 and E_3 is draw to scale = -1 mark

No label and wrong ratio between E_2 and E_3 = -2 marks

Comments:

1. Generally well done for the intervals where E = 0 V. Note that the sketch must be drawn clearly for E = 0 V. No BOD is awarded if students leave this portion blank.
2. ECF was awarded if students labelled E_2 with the values from **(ii)**.
3. Most students did not realise that E_3 is ¼ E_2. It was common to see E_3 presented as ½ E_2.

(iv)

The iron core increases the magnetic flux density, [M1]
resulting in a larger rate of change of flux linkage.
Hence, the e.m.f. induced in coil Y is larger (when E not zero). [A1]

Comments:

1. This question is similar to the specimen paper question. Despite reminders, students still wrote that the iron core "concentrates the flux/field lines", without making reference to the increase in magnetic flux density.
2. Some thought that the flux will be confined within the iron core.
3. Note the flow of question. Discussion should be based on the effect on the e.m.f. induced in (iii). Some students wrongly stated that the iron core will not affect the induced emf when it is stationary.

6 (a)

-the existence of threshold frequency
-max ke independent of intensity / max ke dependent on frequency (note: NOT proportional)
-instantaneous emission of photoelectrons
[NOT: photocurrent depends on intensity (this observation corresponded to the prediction)]

[any 2 correct - 2 marks]

Comments:

1. A recall-type of question, which students can score well if they have done the book work.

(b)

(i)

$$KE_{\max} = eV_s$$
$$= \left(1.6\times10^{-19}\right)0.2$$
$$= 3.2\times10^{-20}\ \text{J} \qquad \text{[B1]}$$

(ii)

$$\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + eV_s$$

$$\frac{6.63\times10^{-34}\left(3.0\times10^{8}\right)}{550\times10^{-9}} = \frac{6.63\times10^{-34}\left(3.0\times10^{8}\right)}{\lambda_0} + 3.2\times10^{-20}$$ [M1]

$\lambda_0 = 6.03\times10^{-7}$ m [A1]

Comments:

1. The calculations were very well done.
2. Common mistake: some students equated $\frac{hc}{\lambda_0}$ to eV_s.

(iii)

The relationship between *Vs* and radiation wavelength is <u>not linear</u>, hence the curve cannot be extrapolated with 2 data points [B1]

Comments:

1. Very poorly done. No mark is granted for students who stated that there are insufficient points to deduce the trend, or that V_s and λ <u>*may not*</u> be linear. Rearranging the Einstein photoelectric equation (which is applied in (ii)), it can be seen clearly that V_s is linearly related to $\frac{1}{\lambda}$.

$$V_s = \frac{hc}{e}\frac{1}{\lambda} - \frac{\Phi}{e}$$

2. Students should also note that linearly related ($y = mx + c$) does not have the same meaning as proportional ($y = mx$).

3. Most students simply stated that the work function energy is not given, or that the threshold wavelength falls outside the range of the graph. Note that 6.03×10^{-7} m is clearly within the range of the graph.

(iv)

<u>Each photon has more energy</u>, but [M1]
<u>rate of incident photon is lower</u>. Hence, the <u>rate of emission of photoelectron is lower</u> and <u>photocurrent decreases</u>. [A1]

Comments:

1. Very poorly done. Vast majority of the cohort stated that photocurrent remains the same since intensity remains the same. Note that intensity is proportional to current for constant wavelength (or frequency) only.
2. Since intensity = $\frac{N_{photon}E_{photon}}{t.Area} = \frac{N_{photon}}{t.Area}\frac{hc}{\lambda}$, when λ decreases, $\frac{N_{photon}}{t}$ has decrease to keep the intensity constant. Students who used this

equation should state clearly what each symbol represents. Some thought that current $I = \frac{N_{photon}}{t} \times e$. Note that not all photons cause the emission of electrons; photons are also reflected or transmitted. Hence, rate of electron emission is lower than rate of incident photons. Current $I = \frac{N_{electron}}{t} \times e$ instead.

3. Other common **mistakes**:
   - higher frequency ➔ higher rate of incident photons.
   - higher maximum KE ➔ higher charge flow rate ➔ larger current

7

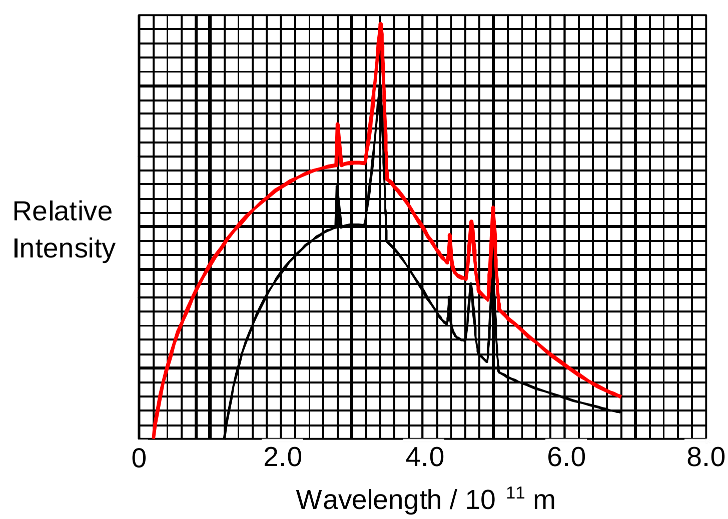


Fig. 7.1

(a)

- X-ray photons are produced when highly energetic electrons are suddenly decelerated.

The most energetic X-ray photon is produced when

- an electron stops in one collision
- and all its kinetic energy goes to one photon

any two of above three bulleted points [B1]

Comments:

4. many students did not have “highly energetic” (or high speed), “suddenly”, “stops”, “one” and “all” in their answers
5. some students’ answers are for characteristic wavelengths
6. some students mixed up this with photoelectric effect (e.g. saying knocking out electrons near the surface of metal to have max energy)

(b) (i)

When the highly energetic electrons knock out the electrons in the K-shell of the atoms and leave a vacancy.
Electrons in the next higher energy level, L-shell, transit down to the vacancy and K_{α} photons are produced with energy equal to the energy difference between the 2 energy levels.

Comments:

7. some students say exciting K-shell electron to L-shell instead of knocking out
8. some students say knocking out outermost (valence) electron instead of knocking out the innermost electron (K-shell)
9. some students say M-shell instead of L-shell

~~10.~~ some students say higher level instead of specifically L-shell

(ii)

$\lambda \approx 3.4 \times 10^{-11}$ m

$$p = \frac{h}{\lambda} = \frac{\left(6.63 \times 10^{-34}\right)}{3.4 \times 10^{-11}} = 1.9488 \text{ J} = 1.95 \text{ J}$$

Comments:

11. generally well done

(b)

Same characteristic wavelengths, lower threshold wavelength, higher intensity

Comments:

12. many students draw cutting the same horizontal intercept

8 (a)

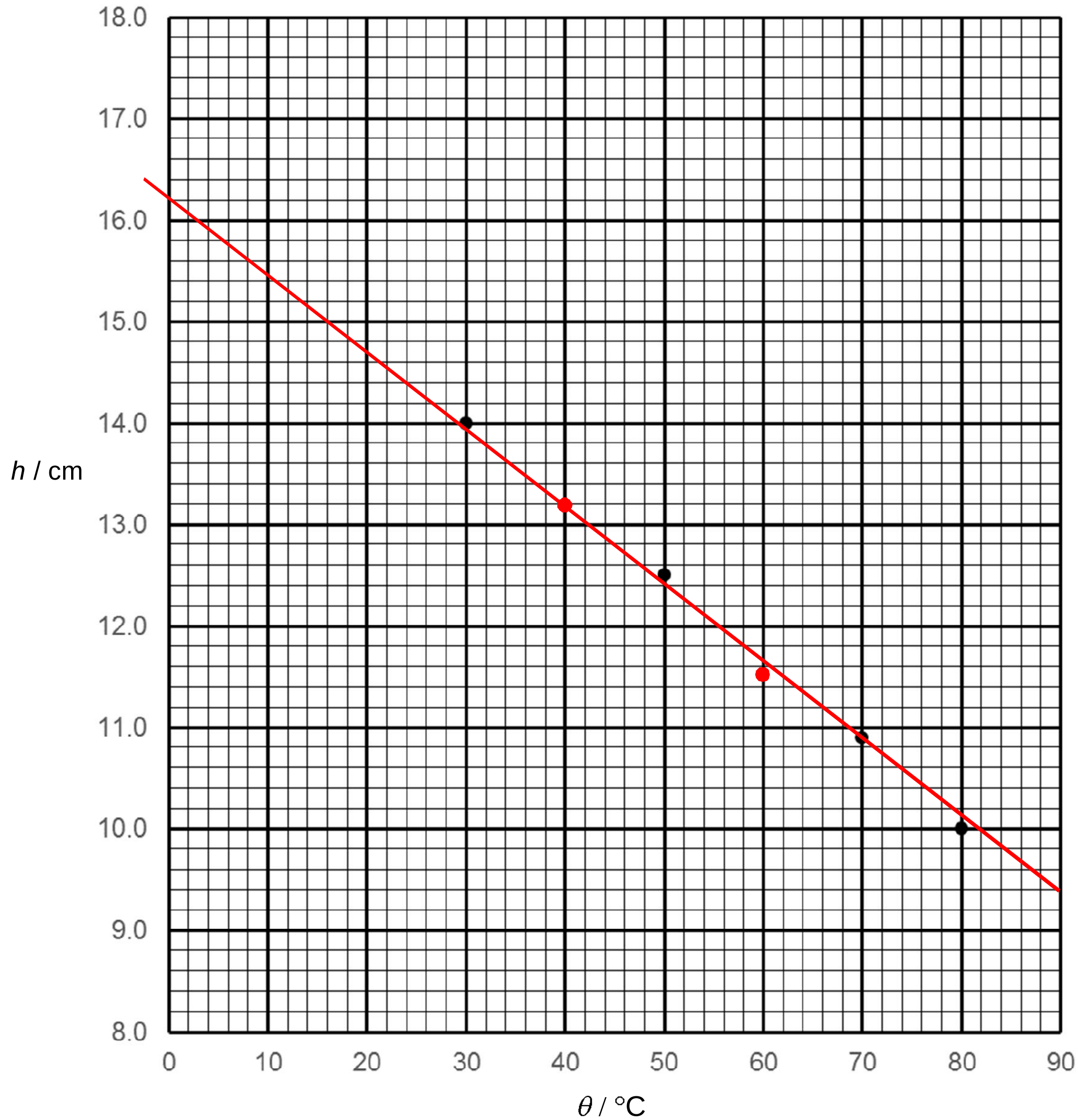


Fig. 8.3

(i)

Both points plotted correctly [B1]
Appropriate line of best fit [B1]
Comments:
Generally very well attempted.

(ii)

Correct read off from vertical intercept [B1]

h_0 = 16.2 cm

Comments:

Generally very well attempted. Almost all candidates can read off the vertical intercept with no problems. E.c.f. is given even if line of best fit is not appropriate.

(iii)

Rearrange to linear form: $h = h_0 - h_0 k\theta$ [B1]

State that a linear line is obtained / linear trend of data [B1]

State that gradient = $-h_0 k$, and vertical intercept = h_0 [B1]

Last B1 not awarded if student state gradient = $h_0 k$

Comments:

Most students are able to recognise that the equation is of the linear form. However, it is important to make reference to the line in Fig. 8.4 on how it can fit the relationship given. A handful of candidates did not do that.

(iv)

Gradient $= \dfrac{13.8 - 10.6}{32 - 74}$ [M1]

$= -0.0762$

$k = -\dfrac{\text{gradient}}{h_0} = -\dfrac{-0.0762}{16.2} = 4.70 \times 10^{-3}$ [A1]

Units = $°C^{-1}$ [B1]

Substitution of coordinates into equation to find *k* (no credit given)

If gradient coordinates used does not lie on line (e.g. use data point), minus 1 mark.

Minus 1 mark if gradient coordinates cannot be traced back to the graph (ie. Show 2 pairs of coordinates in the gradient calculations).

Comments:

Most student are able to hand this well. However, it should be noted that coordinates used to calculate the gradient should be sufficient far apart, as part of good analysis skills.

There are also a minority of candidates who substituted a pair of coordinates into the given equation to find *k*. This is not accepted.

Most are also able to give the correct units.

Comments mistakes in units include θ^{-1}, K^{-1}.

(b)

(i)

Graph is of form $h = \frac{C}{r}$ where C is a constant (= gradient) [M1]

$C = \frac{(30.0 - 0) \times 10^{-2}}{(20.5 - 0) \times 10^{3}} = 1.46 \times 10^{-5}$ [M1]

$r = \frac{C}{h} = \frac{1.46 \times 10^{-5}}{25} = 5.85 \times 10^{-7}$ m [A1]

Comments:
Surprisingly not well attempted by a number of candidates. Many had trouble handling the factor of 10^3 in the value of (1/r).
Common mistakes include:

- Finding r at h = 25 cm instead of extrapolating to 25 m
- Wrongly or forgot to put in factor of 10^3 in calculations

(ii)

The trend of graph remains linear throughout all values of h (or up to 25 m) / h is inversely proportional to r throughout all values of h (or up to 25 m) [B1]
Comments:
A good number of candidates gave the correct response. Responses which are not related or did not draw reference to Fig. 8.4 are generally not accepted.

(iii)

Radius of bore obtained is too small [B1]
Unlikely that capillary action is the only means [B1]
Comments:
Poorly attempted. Many could recognise that the radius of the bore seemed unlikely due to the small value, but could not gave further elaboration.
Note that no e.c.f. is given if the value obtained in **(b)(i)** is of a different order of magnitude to the correct answer.

(c)

(i)

Evaporation of water through leaves (transpiration) [B1]
creates a low water vapour pressure in the bore
Comments:
Poorly attempted. This is about how low pressure can be created in a tree, not how it can be created experimentally.
Common mistakes:

- Use a vacuum pump
- Drill holes in the trees
- Lower atmospheric pressure (how is it possible to do this?)
- Lower temperature of water in the bore

(ii)

$\Delta p = h\rho g$

$(101 - 7.8) \times 10^{3} = h(1000)(9.81)$ [M1]

$h = 9.5$ m [A1]

Comments:
Well attempted. Most could recognise that the pressure difference gave rise to the height of the water column.
Common mistakes:

- Added the atmospheric pressure to the pressure in the bore.
- Simply used the pressure in the bore only.

(iii)

Evaporation rate will be higher; pressure difference will be greater [M1]
Hence height increases [A1]
OR
Water density will be lower [M1]
Hence height increases [A1]
OR
Bores of the capillary tubes becomes wider; lesser capillary action [M1]
Hence height decreases [A1]

Comments:
Poorly attempted. What was required was simply an answer which is logical and make good Physics sense. Hence a large variation of answers were accepted.
Other accepted answers include:

- Higher temperature causes atmospheric pressure to increase, thus greater pressure difference between atmosphere and bore, height increases.
- Making reference to Fig. 8.3, and noting that capillary action reduces.
- Higher temperature causes pressure in the bore to increase, thus smaller pressure difference between atmosphere and bore, height decreases.

Common mistakes:

- Higher temperature causes water to expand, hence occupy greater volume, thus height increases (this answer is not accepted as the fundamental principle of pressure difference is not accounted for)
- Many candidates also did not specify clearly which pressure they are referring to (atmospheric or bore)