No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

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90939

909390

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Level 1 Physics, 2016

90939 Demonstrate understanding of aspects of heat

2.00 p.m. Tuesday 15 November 2016
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of heat.	Demonstrate in-depth understanding of aspects of heat.	Demonstrate comprehensive understanding of aspects of heat.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Make sure that you have Resource Sheet L1–PHYSR.

In your answers use clear numerical working, words and/or diagrams as required.

Numerical answers should be given with an appropriate SI unit.

Useful information for calculation questions is available in the Resource Booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 11

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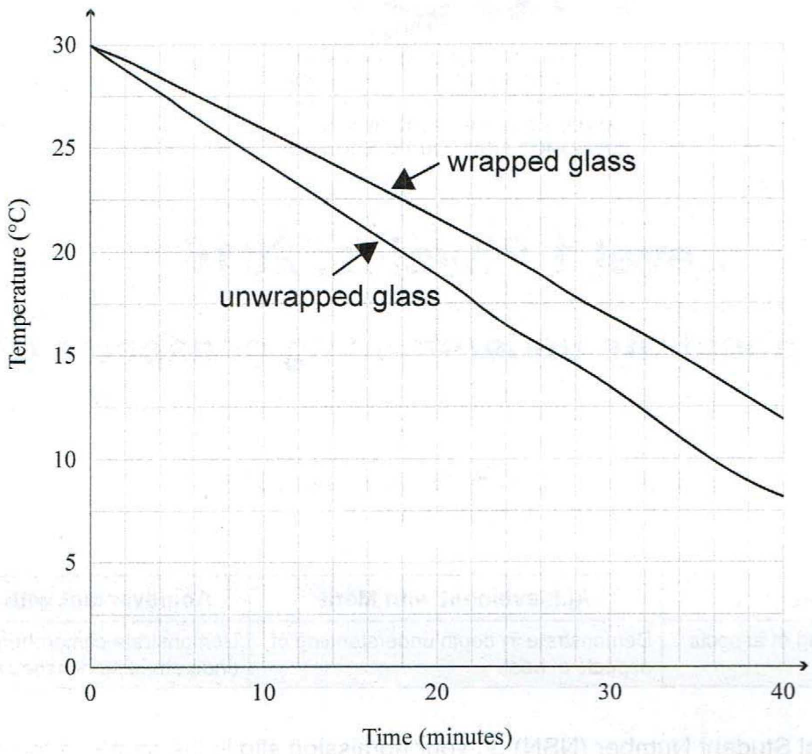
QUESTION ONE: COOLING YOUR DRINK

Bill and Ted want to find a fast way to cool down their drinking water in summer. Bill told Ted that if you wrap tissue paper around a drink and then put it in the freezer, it will cool down faster.

They decided to test this theory, so they got two identical glass bottles, and filled each glass bottle with 600 g of water. Bill and Ted then screwed on the caps and wrapped one with tissue paper. Both bottles were placed in the freezer and the results are shown in the graph below.



(a) From the graph it can be seen that both bottles lost heat energy. State where the heat energy was lost to.

The surrounding environment

(b) Both bottles were placed on the bottom of the freezer without touching each other.

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Explain, in terms of heat transfer methods, how the unwrapped bottle lost heat energy AND why this bottle would cool faster than the wrapped bottle.

~~The~~ Both bottles are losing heat due to conduction, the unwrapped bottle is exposed directly to the environment, whereas the wrapping on the other bottle* means that inorder for it to heat up the heat from the surrounding environment first has to heat up the air in the tissue ~~pa~~ paper, so it takes longer to warm up

*acts as insulation and this

(c) The power rating of the freezer is 0.2 kW.

Calculate the time in **minutes** for 600 g of water at 0°C to freeze into ice at 0°C.

~~$t = E/P$~~ $Q = mL$

$Q = 0.6 \times 330\,000$

$Q = 198000\,J$

$T = E/P$

$T = 198000/P$

$P = 0.2 \times 1000 = 200$

$T = 198000/200$

$T = 990s$

$990s = 16.5$ minutes

Time: 16.5 ~~min~~ minutes

(d) Bill suggested to Ted that they could try a different freezer that had a power rating of **0.4 kW**.

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Explain how doubling the power rating of the freezer would affect the time taken for the 600 g of water at 0°C to freeze into ice at 0°C.

198000/400 = t
t = 495 s
t = ~~8~~ 25 min

The relasionship between the power rating and time is inversely proportional, ~~doub~~ doubling the power rating will half the time.

M6

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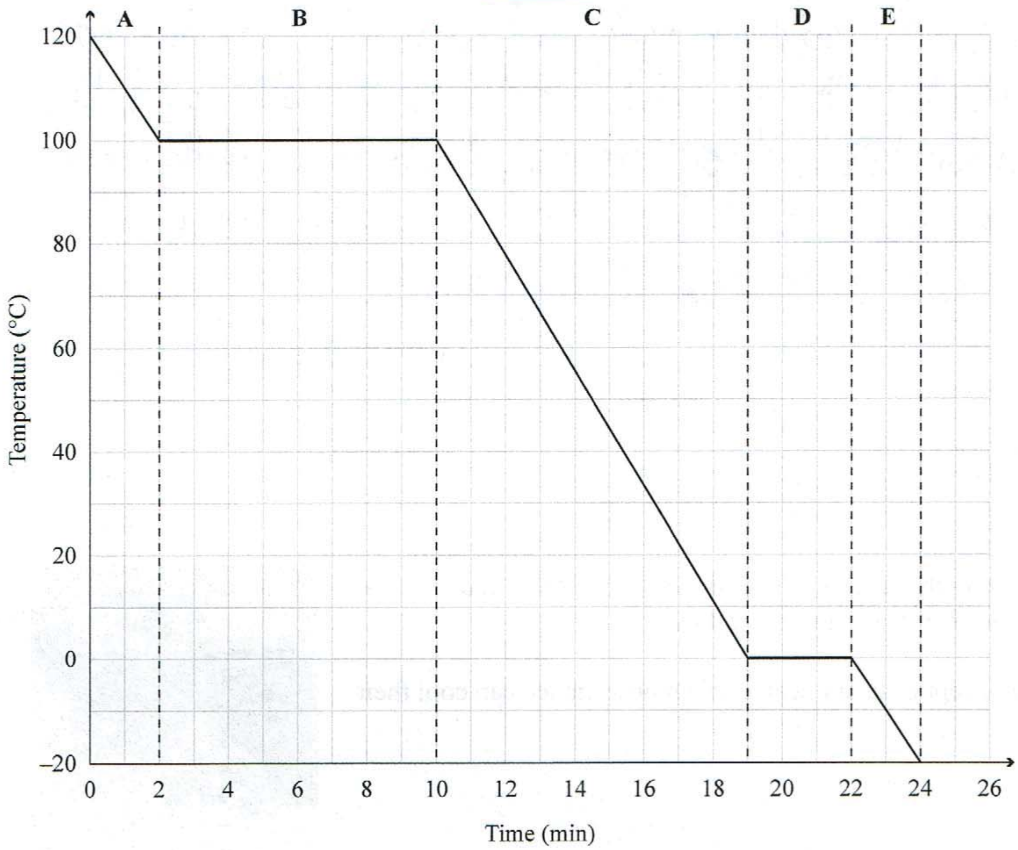
QUESTION TWO: COLD DRINK

Bill and Ted want to learn more about how to cool down their drinks. They look at a graph of cooling water to help them understand the process of cooling.



(a) Use the graph above to give the names of the:

(i) phases (states of matter) of sections A, C and E

Section A: Gas Section C: Liquid Section E: Solid

(ii) processes occurring during sections B and D.

Section B: ~~Latent~~ Latent heat of vapourisation Section D: Latent heat of fusion

(b) (i) Give the definition of latent heat.

The amount of energy needed to change a substance from one state to another when no temperature change is occuring.

(ii) The graph on the previous page shows that the temperature is constant in Section D.

Explain, in terms of particle motion, what has happened to the water during Section D.

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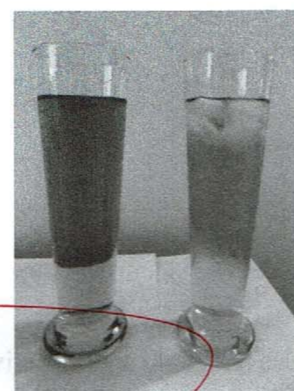
The particles in a solid are tightly packed together and as the heat up they vibrate. When the object is heated to its melting point, the temperature briefly stops increasing, this is so the particles can gain energy to break away from one another, instead of continuing to increase in temperature

(c) Instead of using the freezer to cool down their drinks, Ted decides to put ice into their water to cool it down.

Using the concept of latent heat, explain how the ice can cool their drinks.



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(d) Ted then puts some ice into a glass of water.

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Calculate the total amount of energy required to change 65 g of ice at –5°C into 65 g of water at 8°C.

Start by calculating the energy required to raise the temperature of the ice from –5°C to 0°C.

$Q = mc\Delta T$

$Q = 0.065 \times 2100 \times 5$

$Q = 682.5\,J$

$Q = mc\Delta T$

$Q = 0.065 \times 4200 \times 8$

$Q = 2184\,J$

682.5 J

+ 2184 J

= 2866.5

Total energy: u

N1

QUESTION THREE: STAY COOL

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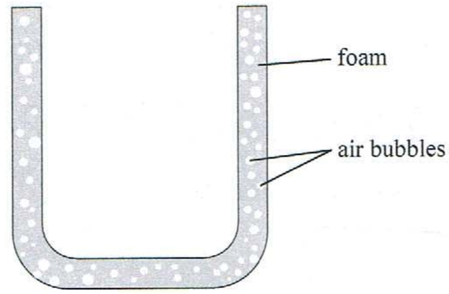
Now that Bill and Ted have cooled their water, they want to keep it cool. They have decided to invest in a bottle holder called a Koozie. A Koozie is usually made from foam rubber that will fit over a bottle. Foam rubber is a material that has been created to have air pockets inside it.



(a) Describe how the foam material of the Koozie helps to keep the drink cool.

The ~~th~~ air bubbles in the foam mean that ~~heat air~~ warm air passing through the foam will lose its heat as majority it will warm up the pockets of air instead of the liquid in the bottle

(b) Bill and Ted find that their drinking water is still warming up.

State and explain any modification that could be done to the Koozie to help reduce the rate of heat energy transfer.

If the outside was ~~a~~ light and reflective ~~it~~ it would ~~b~~ prevent the drink heating up due to radiation as the black dull colour it is is the best combination to absorb radiation, whereas if it was reflective ~~the~~ heat gain due to radiation would significantly decrease

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(c) Bill noticed that water had **condensed** on the outside of the water bottle.

Calculate the mass of the water that condensed if 12 000 J of energy was released during the condensation process.

Give your answer in **grams**.

M=Q/~~M~~L
Q=12000J
L=2 300 000
M=12000/2300000
=0.00521739

Mass: 0.00523

(d) In their research they found that in some countries people tend to drink hot drinks to try to increase their sweating to therefore lower their body temperature.

(i) Explain how drinking a hot drink could lower a person's body temperature.

Drinking a hot drink would increase the bodies temperature, this would mean the body to secrete more sweat to cool down. Sweat incibles people to cool down ~~p~~ because so it can evaporate it takes heat energy from the person, This means it has enough energy to change state and the person ~~feels~~ is cooler

There is more space for your answer on the following page.

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(ii) Explain why drinking a hot drink in high humidity would be less effective at lowering the body temperature of a person than drinking a hot drink in low humidity.

Humidity is the amount of water in the air, the higher the humidity the more water. Trying to cool down, by ~~increasing~~ ~~how much~~ drinking hot drinks to increase how much you sweat would be ineffective on a humid day. As ~~the~~ your sweat would be unable to evaporated, you would not cool down

A4

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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Annotated Exemplars

Achievement exemplar for 90939 2016			Total score 11
Q	**Grade score**	**Annotation**	
1	M6	(a) **Achieved.** This response provides evidence towards Achievement by providing a description of where heat energy was lost to. (b) **Achieved.** There is a description of heat transfer by conduction or by radiation and a description of tissue paper acting as an insulator/poor conductor. For Merit, this candidate could have provided a complete explanation of the heat transfer. (c) **Excellence.** This response provides a full answer as there is a complete set of correct calculations including units. (d) **Achieved.** There is a clear description and calculation of the time taken being halved. For Merit, this candidate could have provided a more complete answer by indicating that the amount of energy needed to be transferred is constant in both cases.	
2	N1	(a) **Not Achieved.** Names of processes only partially correct. (b) (i) and (ii) **Not Achieved.** Latent Heat incorrectly defined – it is required or given out for a change of state - and an incorrect explanation of particle motion when water freezes. (c) (i) and (ii) **Not Achieved.** No response. (d) **Achieved.** There are two correct specific heat calculations for the energy required to change the temperature of the ice and the water. For Merit, the candidate needs to provide an additional correct calculation for latent heat of the ice.	
3	A4	(a) **Not Achieved.** For Achieved there needs to be a correct description of the good insulating properties of the foam or the air bubbles. (b) **Merit.** This response provides evidence towards Merit by providing an explanation of a reasonable modification. (c) **Achieved.** There is a correct calculation but for merit there needs to be evidence of a correctly converted final answer from kg to g. (d) (i) and (ii) **Achieved.** There is a partial description of how sweat lowers a person’s body temperature	