



SAMPLE ASSESSMENT TASKS

PHYSICS
GENERAL YEAR 11

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Sample assessment task

Physics – General Year 11

Task 3 – Unit 1

Assessment type: Science inquiry – Investigation

Conditions

Time for the task: 90 minutes

Task weighting

10% of the school mark for this pair of units

Task 3: Investigation of refraction and critical angle

Refraction is the change in direction of light waves as they travel through different media.

Your group's task is to use a light box to investigate the amount of refraction caused by different materials, e.g. crown glass, water, glass, plastic.

Class discussion: How can the change in direction of light as it passes through different media be measured?

Part A: Refraction

- Investigate the bending of light as it travels through different substances.
- Decide how you can measure this.
- Do different substances change the direction of light by different amounts?
- Which of the substances that you tested had the highest refractive index (bent light the most)?
- Refractive indices can be calculated using Snell's Law: $n_1 \sin i = n_2 \sin r$.
- Calculate the refractive index of one of your materials using your data.

Part B: Critical angle

- Increase the angle of incidence and observe the angle at which the light stops exiting the substance and instead reflects back into it (total internal reflection).
- Draw a diagram of the light ray as it enters the material and reflects off the internal surface of the material. From your measurements, determine the angle of incidence at which total internal reflection first occurs in each material. This is the critical angle for the material.
- Is this angle the same for each substance?
- Is there a relationship between the refractive index of a material and the angle where the light is totally internally reflected (critical angle)?

Stages of the Investigation

Stage 1 – Planning

In groups, plan Parts 1 and 2 of the investigation, and decide which equipment you will need. Use the *Planning and Report Worksheet for Science Investigations*.

Stage 2 – Conducting

Conduct Parts A and B of the investigation.

Stage 3 – Processing

Record your group's results for Part A and Part B, and process them by answering the questions. Evaluate your investigation and repeat any section, if needed.

Stage 4 – Evaluation

Write a report on the investigation and submit it.

Use the following *Planning and Report Worksheet for Science Investigations* to assist with writing up your investigation.

Planning and Report Worksheet for Science Investigations

Student name _____

Other members of your group _____

Stage 1 – Planning

(8 marks)

What is the question you are investigating?

What do you know about this topic from personal experience and from science?

Which variables may affect the phenomenon you are investigating?

Which of the variables are you going to investigate as your independent variable? (This is the variable you will change to see what effect it has on the dependent variable.)

How will the independent variable be changed in the experiment?

What is the dependent variable (i.e. the variable that responds to changes in the independent variable)?

How will you measure the dependent variable?

Write a hypothesis for the investigation.

Predict what you think will happen and explain why you think this.

Which variables are to be controlled (kept constant) to make it a fair test?

Describe your experimental set-up using a labelled diagram and explain how you will collect your data.

Are any special safety precautions required?

Stage 2 – Conducting

(13 marks)

Carry out some preliminary trials. Were there any problems?

How did you modify your experiment to fix the problems?

Collect and record the data you need to test your hypothesis.

Draw your data table here. Organise your results in a clear, logical manner.

Title of table: _____

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Calculate the refractive index of one of your samples. Show your working.

Stage 3 – Processing

(9 marks)

Analyse your data. Are there any patterns or trends in your data? What is the relationship between the variables you have investigated? Is the hypothesis supported by the data?

Use science concepts to explain the patterns, trends or relationships you have identified in your data. What is your conclusion?

Stage 4 – Evaluation**(6 marks)**

What are the main sources of experimental error?

How confident are you with your conclusions? How much uncertainty/error is associated with your data?

How could the design of the experiment be improved to reduce error?

What have you learned about the topic of your investigation? Was the outcome different from your prediction? Explain.

ACKNOWLEDGEMENTS

Planning and Report Worksheet questions

Adapted from: Hackling, M. W. (2005). *Working scientifically: Implementing and assessing open investigation work in science* (Rev. ed.). (Appendices 2 & 3: Planning and report worksheet for science investigations). Perth: Department of Education and Training, pp. 27–38.

Marking key for sample assessment task 3 – Unit 1

Description	Marks
Stage 1 – Planning	
Develops a clear hypothesis which relates the variables	1–2
Lists all materials required	1–2
States how controlled variables were controlled (aligning edge of sample exactly with ruled line etc.)	1–2
Plans for repeat trials (at same angle, at different angles)	1–2
	/8
Stage 2 – Conducting	
Clearly lists the procedure to be used:	
<ul style="list-style-type: none"> produce narrow light ray carefully trace rays and border of sample construct normals and measure angles of incidence and refraction repeat with different angles of incidence increase angle of incidence until total internal reflection occurs 	1–5
Shows a labelled diagram or photograph of equipment set-up	1–2
Selects appropriate equipment and collects accurate results	1–2
Constructs a labelled diagram showing total internal reflection	1–2
Displays data in suitable format	1–2
	/13
Stage 3 – Processing	
Averages data from repeat trials	1–2
Shows working to calculate refractive index	1
Calculates refractive index correctly	1
Makes a valid statement about trends in the data	
<ul style="list-style-type: none"> compares different materials relates angle of incidence and angle of refraction relates refractive index and critical angle 	1 1 1
States conclusion and relates it to the hypothesis	1–2
	/9
Stage 4 – Evaluation	
Discusses sources of uncertainty in the data	1–2
Makes reasonable suggestions for improvements to procedure (e.g. draw thinner lines, align eye with rays)	1–2
Uses appropriate scientific terminology in the discussion	1–2
	/6
Total	/36

Sample assessment task

Physics – General Year 11

Task 4 – Unit 1

Assessment type: Extended response

Conditions

Period allowed for completion of the task: 3 weeks

Task weighting

15% of the school mark for this pair of units

Task 4: Extended response: Vision in animals

Class discussion

- How does the lens in the eye help us to see?
- How do other parts of the eye help us to see?
- How does changing the shape of the lens affect vision?
- Do all animals have the same shaped lens?

Your task is to **select one vertebrate** animal (e.g. horse, eagle, mouse, fish, snake, frog) and **one invertebrate** animal (e.g. spider, fly, ant, snail, crab, scorpion, bee) and research how they see the world.

Questions you should try to answer about each animal include:

- What type of images does the animal see?
- Can the animal see all the colours visible to humans?
- Can the animal perceive waves from outside the visible spectrum?
- Do its eyes have a focusing mechanism? How does it work?
- Compare the vision systems of your two selected animals and relate them to the requirements of the animal (e.g. if the animal is nocturnal, how does its vision help it; if the animal is a hunter, how is its vision adapted for this).

Present your findings as a poster or a multimedia presentation. Be prepared to discuss your presentation with class members and answer relevant questions.

Include a list of at least **three (3)** references that you used for your research. Where web-based resources are used, give the html address, the date accessed, and the author and/or publisher if possible.

Marking key for sample assessment task 4 – Unit 1

Description	Marks
Research on vision systems	
Vertebrate	
Describes the type of images perceived	1–2
Describes the type of waves perceived	1–2
Describes how the eye focuses	1–2
Invertebrate	
Describes the type of images perceived	1–2
Describes the type of waves perceived	1–2
Describes how the eye focuses	1–2
Compares the vision systems of these vertebrate and invertebrate organisms	
• Compares structure of the systems	1–2
• Compares how each system focusses	1–2
Compares the images perceived by vertebrate and invertebrate	
• Compares the resolution of each image and the electromagnetic waves each uses	1–2
• Relates the vision system to each animal's lifestyle	2–4
Presentation	
Presents information clearly and logically	1–2
Uses a clear voice	1
Uses appropriate audiovisual aids	1–2
Answers relevant questions	1–2
Lists references (at least three)	1–3
Total	/32

Sample assessment task

Physics – General Year 11

Task 7 – Unit 2

Assessment type: Test

Conditions

Time for the task: 45 minutes under test conditions

Task weighting

8% of the school mark for this pair of units

Task 7: Heat test

Total marks = 51

Student name _____

Question 1

(9 marks)

- a. People wear clothing to keep themselves warm on a cool day. Explain how this works. (4 marks)

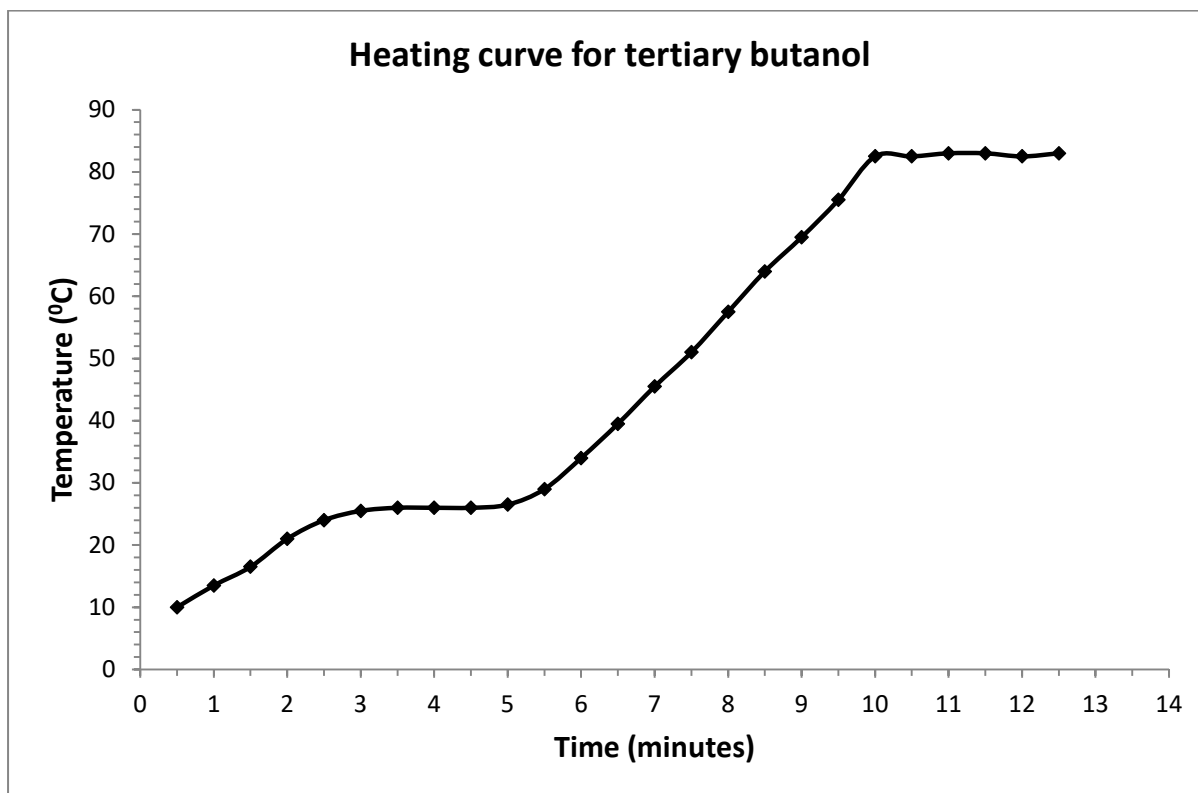
- b. When someone has been in an accident and is in shock, paramedics wrap the person in a survival blanket made from shiny silver plastic foil to keep the person warm. How does this blanket work? (2 marks)

- c. When we are hot, we sweat. Use your science understanding to explain how this helps to cool us down. (3 marks)

Question 2

(9 marks)

A sample of a white crystalline solid called tertiary butanol is gently heated for 13 minutes and its temperature is graphed below. Use the graph below to answer the questions that follow.



- a. For this substance, determine its
- (i) melting point _____
 - (ii) boiling point _____ (2 marks)
- b. Name the process occurring between 3 and 4.5 minutes. (1 mark)
- _____
- c. Is heat absorbed or released during the process occurring between 3 and 4.5 minutes? (1 mark)
- _____
- d. Explain what is happening to the behaviour of the particles in the substance between 5 and 10 minutes. (4 marks)
- _____
- _____

- e. Name the process occurring between 10 and 12.5 minutes. (1 mark)

Question 3 (8 marks)

- a. In areas where summers are hot, house designers do not recommend installing dark roofs on houses as it makes the houses hotter. Explain why this is so. (2 marks)

- b. Describe two design features (other than roof colour) that can be used in houses to keep them cooler in summer or warmer in winter. Explain why each of these design features works. (6 marks)

Feature one _____

Feature two _____

Question 4 (4 marks)

A metal pot filled with water is placed on a gas burner to heat it. Name the heat transfer processes occurring during:

- a. transfer of heat from the flame to the metal pot (two processes). (2 marks)

- b. transfer of heat through the metal of the pot. (1 mark)

- c. transfer of heat throughout the water. (1 mark)

Question 5**(14 marks)**

To decrease the change of temperature in buildings, large amounts of concrete can be used in the construction of the building. The concrete absorbs heat when the weather is hot and releases it at night or when the weather is cold.

Newer materials called phase-change materials can also be used to hold heat for releasing later. These materials absorb excess heat by changing from solid to liquid and then release heat when it is cold by changing from liquid to solid.

A building designer is comparing the properties of concrete and a phase-change material to determine which is better for controlling house temperatures.

The designer knows the concrete has a specific heat capacity, c of $920 \text{ J kg}^{-1} \text{ K}^{-1}$.

Use the equations $Q = mc\Delta T$ and $Q = mL$ to answer the following questions.

- a. Calculate the amount of heat absorbed by the concrete as its temperature rises by 10°C .
Show your working. (2 marks)

- b. If the phase-change material being investigated has a latent heat of fusion of $1.89 \times 10^5 \text{ J kg}^{-1}$, what mass of the material is needed to absorb the same amount of heat as the 100 kg of concrete (as calculated in part a)? (3 marks)

- c. Which substance is more efficient at absorbing heat?
Explain why this might be so. (2 marks)

- d. Describe the behaviour of the particles in the phase-change material as it starts to warm up. (2 marks)

- e. Describe the behaviour of the particles in the phase-change material as it melts. (2 marks)

- f. As the phase-change material melts, its temperature is constant even though it is being heated. Where is the heat energy going during the melting process? Refer to the energy of the particles. (3 marks)

Question 6

Joel and Bec are doing an experiment with balloons to investigate the relationship between pressure, volume and temperature. They carry out the actions listed below in the first column of the table.

Fill in their observations in the table below using the words **increased**, **decreased** or **same**. (7 marks)

Action	Pressure	Volume	Temperature
Joel blows air into the balloon			No answer required
Bec inflates the balloon a little and ties it tightly, and then puts it into a bowl of hot water			
Joel squeezes the tied blown up balloon with his hands			No answer required

Marking key for sample assessment task 7 – Unit 2

Heat test

Total marks = 51

Q1

- People wear clothing to keep warm on a cool day. Explain how this works.
- When someone has been in an accident and is in shock, paramedics wrap the person in a survival blanket made from shiny silver plastic foil to keep the person warm. How does this blanket work?
- When we are hot, we sweat. Use your science understanding to explain how this helps to cool us down.

Description	Marks
a. People radiate body heat	1
Body heat warms the air near the body	1
Clothing keeps the layer of warm air near the body	1
Clothing is an insulator	1
b. People radiate body heat	1
The silver blanket reflects the radiated heat back to the body	1
c. Sweating produces a layer of moisture on the skin	1
In order to evaporate, sweat needs to absorb latent heat	1
Sweat absorbs heat from the body, cooling it down	1
Total	/9

Q2

- For this substance, determine its
 - melting point
 - boiling point
- Name the process occurring between 3 and 4.5 minutes.
- Is heat absorbed or released during the process occurring between 3 and 4.5 minutes?
- Explain what is happening to the behaviour of the particles in the substance between 5 and 10 minutes.
- Name the process occurring between 10 and 12.5 minutes.

Description	Marks
a. (i) melting point = $26\text{ }^{\circ}\text{C} \pm 1$	1
(ii) boiling point = $82\text{ }^{\circ}\text{C} \pm 1$	1
b. melting (or fusion)	1
c. absorbed	1
d. particles are moving faster	1
due to increased kinetic energy	1
they move apart	1
they move past each other	1
e. boiling or vaporisation	1
Total	/9

Q3

- a. In areas where summers are hot, house designers do not recommend installing dark roofs on houses as it makes the houses hotter. Explain why this is so.
- b. Describe two design features (other than roof colour) that can be used in houses to keep them cooler in summer or warmer in winter.
Explain why each of these design features works.

Description	Marks
a. Dark surfaces absorb radiated heat from the sun They do not reflect the heat away, so house is hotter	1 1
b. Design feature 1 described Uses physics principles to explain how design feature 1 works Design feature 2 described Uses physics principles to explain how design feature 2 works	1 1-2 1 1-2
Total	/8
Answer could include, but is not limited to:	
North-facing windows let winter sun in, keeps the house warm in winter Insulation in the roof and walls keeps winter heat in/summer heat out Curtains with pelmets keep heat in/out because they form a layer of insulating air Double-glazed windows provide a layer of insulating air which keeps winter heat in and summer heat out Deciduous trees planted on north aspect shade the house keeping it cool in summer, but let winter sun in	

Q4

A metal pot filled with water is placed on a gas burner to heat it. Name the heat transfer processes occurring during

- a. transfer of heat from the flame to the metal pot (two processes)
- b. transfer of heat through the metal of the pot
- c. transfer of heat throughout the water.

Description	Marks
a. radiation	1
convection	1
b. conduction	1
c. convection (current)	1
Total	/4

Q5

- Calculate the amount of heat absorbed by the concrete as its temperature rises by $10\text{ }^{\circ}\text{C}$.
- If the phase-change material being investigated has a latent heat of fusion of $1.89 \times 10^5\text{ J kg}^{-1}$, what mass of the material is needed to absorb the same amount of heat as the 100 kg of concrete?
- Which substance is more efficient at absorbing heat? Explain why this might be so.
- Describe the behaviour of the particles in the phase-change material as it starts to warm up.
- Describe the behaviour of the particles in the phase-change material as it melts.
- As the phase-change material melts, its temperature is constant even though it is being heated. Where is the heat energy going during the melting process? Refer to the energy of the particles.

Description	Marks
a. Recognition that $Q = mc\Delta T$ needed to solve problem $Q = 100 \times 920 \times 10 = 920\,000\text{ J}$	1 1
b. Recognition that $Q = mL$ needed to solve problem $m = \frac{Q}{L} = \frac{9200000}{1.89 \times 10^5}$ $= 4.87\text{ kg}$ (accept follow through mass if value for a is incorrect)	1 1 1
c. Phase-change material absorbs more heat per kg More heat is needed for phase change	1 1
d. Particles vibrate faster Particles spread apart	1 1
e. Particles break out of their solid lattice Particles move past each other	1 1
f. Latent heat is being used to give particles potential energy Heat energy is being used to increase separation between particles and enable them to break out of their lattice	1 1–2
Total	/14

Q6

Joel and Bec are doing an experiment with balloons to investigate the relationship between pressure, volume and temperature. Fill in their observations in the table below using the words **increased**, **decreased** or **same**.

Action	Pressure	Volume	Temperature
Joel blows air into the balloon	Increased (1)	Increased (1)	
Bec inflates the balloon a little and ties it tightly, and then puts it into a bowl of hot water	Increased (1)	Increased (1)	Increased (1)
Joel squeezes the tied blown up balloon with his hands	Increased (1)	Decreased (1)	
		Total	/7