Government of **Western Australia**
**School Curriculum and Standards Authority**

# SAMPLE ASSESSMENT TASKS

## PHYSICS
## ATAR YEAR 11

# Sample assessment task

## Physics – ATAR Year 11

### Task 2 – Unit 1

**Assessment type:** Science inquiry – Investigation

**Conditions**
One lesson for planning and conducting as a group member
One lesson for processing and evaluation to be completed under test conditions

**Task weighting:** 5% of the school mark for this pair of units

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**Determine the specific heat capacity of an unknown solid** **(28 marks)**

You will be given a sample of an unknown material, and are required to determine its specific heat capacity, *c*. Given the formula $\boldsymbol{Q = mc\Delta T}$, plan the measurements you need to make to determine the specific heat capacity of the sample.

Hint: Since it is difficult to measure the temperature of a solid object, you can determine the amount of heat that the sample receives by measuring the heat it gives out to a small volume of water. Heat the object in hot water (which you can measure the temperature of), then transfer the sample to a small volume of room temperature water and allow the water and sample to reach equilibrium.

We assume that **heat gained by cold water = heat lost by solid sample**.

**Plan** all the measurements that you will need to make.

Write your procedure in a sequence of steps and make a list of the equipment you will need. Draw a diagram or take a photograph of your equipment setup. Label it.

Prepare a table for entering your results in.

**Conduct** your investigation using the most appropriate equipment to obtain accurate results.

**To be completed under test conditions**
**Process** your results by calculating the specific heat capacity of the solid.

Include a discussion of the sources of uncertainty in your measurements.

**Evaluate** your investigation, identifying any assumptions that were made, and suggesting modifications which would improve the accuracy of your results.

Complete your report and submit it.

## Marking key for sample assessment task 2 — Unit 1

| Description | Marks |
|---|---|
| **Planning** | |
| Writes a clear procedure which enables replication of experiment | |
| • clearly describes equipment and how it is set up | 1 |
| • describes how trials are to be conducted in a clear logical manner | 1 |
| • description of method allows for investigation to be repeated by others | 1 |
| • states which measurements are to be collected | 1 |
| • plans for repeat trials | 1 |
| Lists necessary equipment in detail e.g. 20 mL graduated cylinder | 1–2 |
| Shows labelled diagram or photograph of equipment setup | 1–2 |
| **Subtotal** | |
| **Conducting** | |
| Collects accurate measurements using appropriate equipment (graduated cylinder, electronic balance) | 1–2 |
| Conducts experiment safely and efficiently – minimal loss of heat and water splashing | 1–2 |
| Accurately records maximum temperature of cold water after adding hot sample | 1 |
| Displays data clearly and logically in a table | 1–2 |
| **Subtotal** | |
| **Processing** | |
| Shows all working to calculate specific heat of sample | |
| • calculates heat gained by water | 1–2 |
| • calculates *c* of sample | 1–2 |
| **Subtotal** | |
| **Evaluation** | |
| Discusses sources of uncertainty in measurement water volume, temperature, mass, loss of heat | 1–4 |
| Identifies assumptions and limitations in the experimental design | 1–2 |
| Suggests possible improvements to the experimental design | 1–2 |
| **Subtotal** | |
| **Total** | **/28** |

# Sample assessment task

## Physics – ATAR Year 11

### Task 1 – Unit 1

**Assessment type:** Science inquiry – Evaluation and analysis

**Conditions**
Time allowed for completion of the task: 2 weeks

**Task weighting:** 5% of the school mark for this pair of units

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**Design an energy efficient building** **(34 marks)**

As the head of a design team, you are required to submit a design for a house, apartment or block of classrooms suitable for the metropolitan area of Perth – hot dry summers and cool winters. Your teacher will provide the brief for the building.

The brief is to reduce power costs by saving on heating and cooling costs through an energy efficient design. The task does not include using alternative sources of electric power such as solar or wind energy, but requires a design which excludes heat in summer and retains heat in the building during the cooler months.

Features that you could consider include the orientation of the building, the position and design of windows or vents, the type of materials in the building, the colour of surfaces, insulation and landscaping around the building. Innovative ideas will be rewarded if you explain how they will contribute to energy efficiency.

The response should be about 3–4 pages in length and should include labelled diagrams, floor plans or a model to illustrate your design features.

Use physics principles to explain why the features that you have incorporated in your design will reduce the need to use electricity for cooling or heating the building.

Be prepared to explain some features of your design to others and to answer questions about your design.

## Marking key for sample assessment task 1 — Unit 1

| Description | Marks |
|---|---|
| Orientation of building is clearly shown and is appropriate<br>Explanation of orientation refers to direction of the sun | 1–2<br>1–2 |
| Location of windows described<br>Appropriate size and type of windows, e.g. side opening to capture breezes, double glazed<br>Appropriate eaves/awnings or shade<br>Description of windows refers to angle of sun in summer and winter | 1–2<br>1–2<br>1–2<br>1–2 |
| Materials for roof and walls described<br>Explanation for selection of materials appropriate, e.g. thermal mass for warming<br>Insulation of roof and walls discussed<br>Physics principles explain insulation selection<br>Colour of roof and walls appropriate<br>Explanation for colour selection | 1–2<br>1–2<br>1–2<br>1–2<br>1–2<br>1–2 |
| Appropriate landscaping described<br>Explanation for choice of landscaping | 1–2<br>1–2 |
| Other innovations incorporated in design, e.g. vents, airflow, thermal mass<br>Explanation of innovations using physics principles | 1–3<br>1–3 |
| **Total** | **/34** |

# Sample assessment task

## Physics – ATAR Year 11

### Task 9 – Unit 2

**Assessment type:** Test

**Conditions**
Time allowed: 50 minutes
You may refer to the Formulae and Data booklet.

**Task weighting:** 9% of the school mark for this pair of units

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## Task 10: Linear motion and force test

**Name** _____ **Total: 50 marks**

Show all working for your calculations, and express answers using appropriate units and significant figures.

**Question 1**

Rebecca and Josh start running along the beach at the same time.
Rebecca accelerates at 2.0 m $s^{-2}$ for 3.0 seconds, and Josh accelerates at 1.3 m $s^{-2}$ for 5.0 seconds.
Then they run at a steady velocity. **(9 marks)**

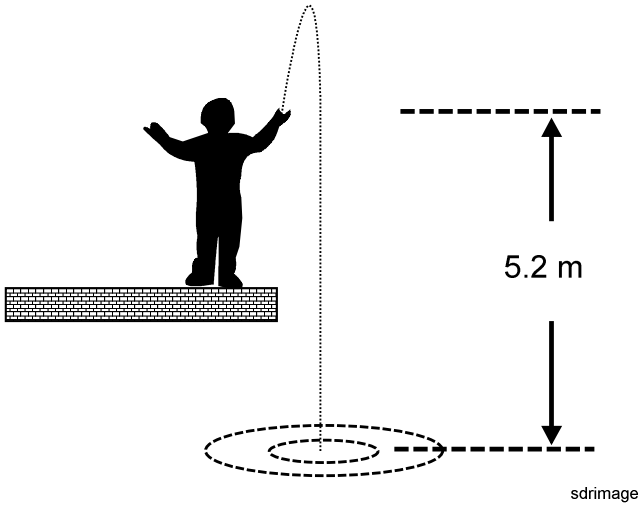
a. Calculate Rebecca's velocity after 3.0 seconds. (3 marks)

b. Calculate how far Josh has run after 5.0 seconds. (3 marks)

c. They both run up the steps and find this more difficult than running on the flat beach. Use physics principles and an equation to explain this observation. (3 marks)

**Question 2**

Ethan stands on a bridge and throws a stone vertically up into the air with an initial speed of 12.0 m $s^{-1}$. The stone eventually falls into the river, 5.2 m below its starting point. **(13 marks)**




a. Describe the stone's acceleration and velocity as it

(i) travels upwards (4 marks)

Acceleration (include direction): _____

_____

Velocity: _____

_____

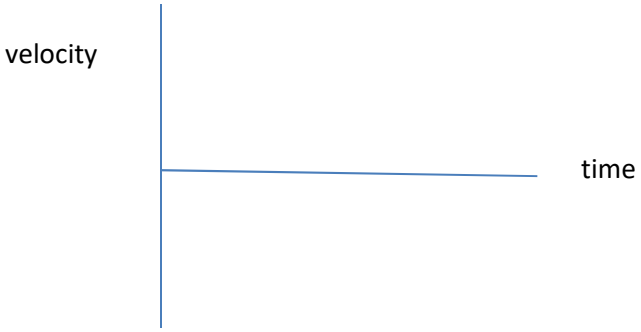
(ii) travels towards the ground. (2 marks)

Acceleration: _____

Velocity: _____

b. Assuming that air resistance is negligible, determine the maximum height reached by the stone, as measured above its starting point. (4 marks)

c. Sketch a graph of the stone's velocity against time, from the time it leaves Ethan's hand until it hits the water. It is not necessary to put numbers on the axes. (3 marks)




**Question 3** **(18 marks)**

A car is travelling at 16.0 m $s^{-1}$ when the driver sees a child run on to the road ahead and brakes suddenly.

a. If the time taken to apply the brakes is 1.2 seconds, and the braking deceleration on a dry road is – 8.0 m $s^{-2}$, how far will the car travel while it is coming to a stop? (6 marks)

b. Draw a free body diagram showing all the forces acting on the car while it is braking. Label the vectors and show their relative sizes by the length of the arrows. Assume the car is travelling towards the right of the page. (4 marks)

c. Determine the change of momentum that a 60 kg passenger will experience as they slow from 16 $ms^{-1}$ to a stop. Show the correct unit in the answer. (4 marks)

d. As the car brakes, the passengers are in danger of colliding with the dashboard of the car. Dashboards are padded so that passengers are less likely to be hurt.

Use physics principles to explain how a soft dashboard protects passengers from injury.

(4 marks)

**Question 4** **(10 marks)**

A crane on a building site lifts a 200 kg steel girder 30 m into the air.

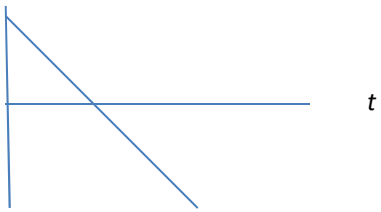
a. Calculate the potential energy gained by the girder. (3 marks)

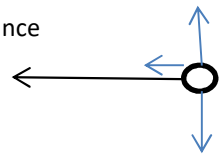
b. If the cable breaks when the girder is at a height of 30 metres, with what velocity will it hit the ground? (4 marks)

c. If it takes 24 seconds for the crane to lift the girder to this height, calculate the power that is being used for the lifting. (3 marks)

# Marking key for sample assessment task 9 — Unit 2

**Linear motion and force test**

| Question | Suggested answer | Marks |
|---|---|---|
| 1 | a. $v = u + at$ | 1 |
| | $= 0 + 2.0 \times 3.0$ | 1 |
| | $= 6.0\ m\ s^{-1}$ | 1 |
| | b. $s = ut + \frac{1}{2}at^2$ | 1 |
| | $= 0 + \frac{1}{2}(1.3) \times 5.0^2$ | 1 |
| | $= 16.2\ m$ | 1 |
| | c. they are working against gravity to raise their body | 1 |
| | and gain potential energy | 1 |
| | $E_p = mgh$ | 1 |
| | **Total** | **/9** |
| 2 | a. (i) acceleration is constant ($9.8\ ms^{-2}$) | 1 |
| | towards ground | 1 |
| | velocity decreases | 1 |
| | until it reaches zero | 1 |
| | (ii) acceleration is constant | 1 |
| | velocity increases | 1 |
| | b. $v^2 = u^2 + 2as$ | 1 |
| | $0 = 12.0^2 + 2(-9.8)s$ | 1 |
| | $s = -144/(-19.6) = 7.35\ m$ | 1–2 |
| | c. $v$   1 mark for starting in positive and decreasing to zero<br>1 mark for constant gradient<br>1 mark for negative velocity after zero | 1–3 |
| | **Total** | **/13** |

| Question | Suggested answer | Marks |
|---|---|---|
| 3 | a. distance travelled during reaction time: $s = vt$ | 1 |
| | = 16.0 x 1.2 = 19.2 m | 1 |
| | distance travelled while stopping: $v^2 = u^2 + 2as$ | 1 |
| | $0 = 16.0^2 + 2(-8.0)s$ | 1 |
| | $s$ = 16.0 m | 1 |
| | Total distance, $s_t$ = 19.2 + 16.0 = 35.2 m | 1 |
| | b. air resistance, reaction force, braking force, gravity  | |
| | 1 mark for gravity and reaction force in opposite directions | 1–4 |
| | 1 mark for gravity and reaction force equal size | |
| | 1 mark for braking force larger than air resistance | |
| | 1 mark for air resistance in same direction as braking force | |
| | c. $\Delta p = m(v-u)$ | 1 |
| | = 60.0 (0 – 16.0) | 1 |
| | = - 960 | 1 |
| | kg m $s^{-1}$ or N m $s^{-1}$ | 1 |
| | d. when passengers collide with dashboard their momentum changes rapidly to zero | 1 |
| | the padding increases the time it takes for the passenger to stop | 1 |
| | since $Ft = \Delta p$ | 1 |
| | if $t$ increases, the force acting on passengers decreases causing fewer injuries | 1 |
| | **Total** | **/18** |
| 4 | a. $E_p = mgh$ | 1 |
| | = 200 x 9.8 x 30 | 1 |
| | = 58800 J | 1 |
| | b. $E_p$ converts to $E_k$ | 1 |
| | so $E_k = ½ mv^2$ = 58800 J | 1 |
| | $v^2$ = 58800 x 2 / 200 | 1 |
| | $v$ = 24.3 m $s^{-1}$ | 1 |
| | c. $P = W / t = E_p / t$ | 1 |
| | = 58800/24 | 1 |
| | = 2450 W | 1 |
| | **Total** | **/10** |
| | **Test total** | **/50** |