2005 Assessment Report

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2005 Systems and Technology GA 3: Written examination

GENERAL COMMENTS

The 2005 Systems and Technology examination was based on all Areas of Study of Units 3 and 4 of the *Systems and Technology VCE Study Design*. In setting the examination, the panel used the outcomes for Units 3 and 4 and the following criteria:

- knowledge of technological concepts and principles associated with integrated systems
- knowledge of technological concepts and principles associated with the control of integrated systems
- understanding of the function of, and interrelationships between, a system and its subsystems
- understanding of the relationship between technological systems and the natural environment
- understanding of the concepts of diagnosis, evaluation, adjustment and repair
- understanding of the role of design in the production of a technological system.

Students were required to answer all questions on the paper.

Following are comments about each question and how marks were assigned. In the case of descriptive answers, sample answers have been supplied.

SPECIFIC INFORMATION

Note: Student responses reproduced herein have not been corrected for grammar, spelling or factual information.

The advice below gives the details required to answer each question. The following should be read in conjunction with the Systems and Technology 2005 examination paper.

Question 1

Question 1 required students to demonstrate an understanding of their production work. This included the ability to carry out both mechanical and electrical/electronic testing and measurement of the system the designed. Students were also required to answer questions regarding the impact their chosen system would have on the environment.

Students were first asked to name the system they had constructed. Subsequent answers to all parts of Question 1 needed to relate to this system.

1a.

Marks	0	1	Average
%	46	54	**0.6**

An 'integrated system' is the term used to describe a system made up of mechanical and electrical/electronic subsystems.

1b.

Marks	0	1	2	3	Average
%	10	13	31	45	**2.1**

bi.

Students had to state here whether the system named was controlled through an open or closed loop.

bii.

For two marks, answers had to be detailed and clearly discuss the components(s) that achieved control in the system. Brief or basic answers that related to the system but may or may not have mentioned the components were awarded one mark.

1c.

Marks	0	1	2	Average
%	8	18	74	**1.7**

A significant mechanical and a major electrical/electronic subsystem that related to the named system had to be stated.

The following is a high-scoring student's response to Question 1. The system named by the student was a dumbwaiter prototype.

1a.
intigrated
1bi.
open loop system
1bii.
In the sytem we built, there was a switch to turn it off, we had a variable resistor (trimpot) to vary the voltage and on the lift subsystem there was a single pole double throw (SPDT) switch to make it go up and down.
1c.
Mechanical subsystem *Lift subsystem*
Electrical/electronic subsystem *Variable Power Supply (VPS)*

Question 2
2a.

Marks	0	1	2	3	4	Average
%	12	7	22	30	29	**2.6**

Students' answers had to relate to the energy conversion taking place in the mechanical system already named. The desirable and undesirable outputs had to relate to the system named and the energy conversion taking place. One mark was given for each correct answer.

2b.

Marks	0	1	Average
%	25	75	**0.8**

The type of motion named had to relate to the type of mechanical subsystem named.

2c–e.

Marks	0	1	2	3	4	5	6	Average
%	19	13	18	11	12	13	15	**2.9**

2c.
To receive two marks, students had to provide detailed knowledge of how the output motion was achieved. Detailed responses that used technical language scored highly. Students who gave brief or general descriptions that related to the named subsystem received one mark.

2d.
The item of test equipment had to be capable of measuring, in a scientific unit, the motion already stated.

2e.
For three marks, students had to provide a comprehensive summary of how the named item of test equipment was set up and then used to test the output motion. Assessors looked for good use of technical language, and specific measurement and mention of scientific units. Two marks were given to less comprehensive descriptions that used technical language and scientific units of measurement. One mark was awarded to any basic description that at least related to the question.

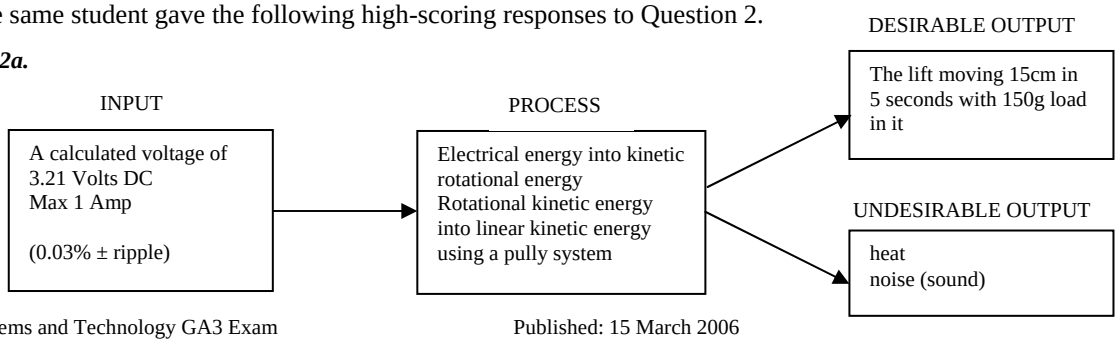
2f.

Marks	0	1	2	3	Average
%	31	34	23	12	**1.2**

Three marks were awarded to comprehensive summaries that detailed how the named undesirable output impacts on the environment. Correct technical language and specific terms were needed. Students who wrote less comprehensive explanations that contained technical language and specific terms were given two marks. One mark was given a brief explanation that related to the question.

The same student gave the following high-scoring responses to Question 2.

2a.



2b.
linear
2c.
The linear motion in part b is achieved by electrical energy converted by a motor into rotational energy, then using our gear box and pullys the motion becomes linear.
2d.
a video camera
2e.
a video camera is used to test the lift, because if you film the lift moving up and/or down, you can see exactly the time it took by moving frame by fram, and knowing how many frames per second to measure the result in meters per second (ms^{-1})
2f.
The heat and sound in this sytem do not have any noticable effect on the environment, except maybe the CO_2 that comes out of power plants where we get our power from for the VPS.

Question 3
3a.

Marks	0	1	2	3	4	Average
%	16	10	23	31	19	**2.3**

The answers had to relate to the energy conversion taking place in the electrical/electronic subsystem already named. The desirable and undesirable outputs needed to relate to the system named and the energy conversion taking place. One mark was given for each correct answer.

3b–d.

Marks	0	1	2	3	4	Average
%	7	11	16	30	36	**2.8**

3b.
A specific voltage and type had to be stated; for example, 12V DC. One mark was given for a quantified voltage; for example, 9Volts or 6V, and one mark for AC or DC.

3c.
The sketch had to be a reasonable approximation of the voltage type stated in 3b.

3d.
The item of test equipment named needed to be capable of measuring the voltage already stated and be able to measure scientific units.

3e–f.

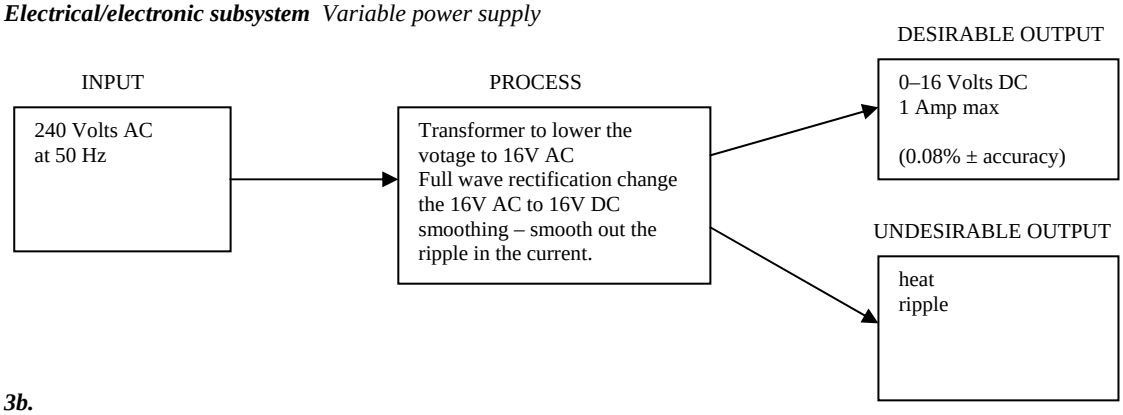
Marks	0	1	2	3	4	5	Average
%	17	18	22	19	17	8	**2.3**

3e.
Students who gave a comprehensive summary of how the named item of test equipment was set up and then used to test the voltage were given two marks. Students needed to use appropriate technical language including specific measurements and scientific units. One mark was given for less comprehensive descriptions that included technical language and scientific units.

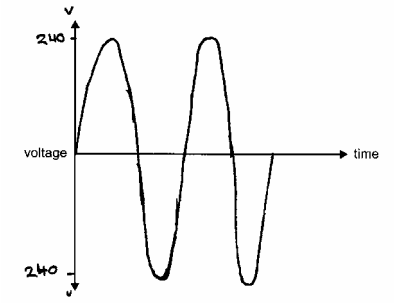
3f.
Three marks were awarded to comprehensive summaries that detailed how the mining, generation, or disposal of the input energy source impacts on the environment. Correct technical language and specific terms were characteristic in these responses. Less comprehensive summaries that still used technical language and specific terms were given two marks. One mark was given for responses that related to the question.

The same student again gave the following high-scoring responses to Question 3.

3a.
Electrical/electronic subsystem *Variable power supply*



3b.
240V AC
3c.



3d.
Voltmeter or Multimeter.
3e.
the wires have to be connected properly at the multimeter then you switch it onto the Volts setting, connect the positive and negative lines properly, and your measurement appears on the screen.
3f.
In the production of energy there is nuclear power, or coal burning, in nuclear power, humans mine a considerable amount of uranium out of the earth, an once they have successfully performed fission, all that is left is unstable Krypton, which is radioactive and in some cases is dumped in places with animals, the radioactivity can mutate their cells, causing them to get sick.

Question 4
4a.

Marks	0	1	2	3	Average
%	5	9	23	63	**2.5**

Students were asked to describe the operation of a waterwheel system in terms of its:

- input – water energy travels down the water channel, creating rotary motion in the water wheel
- process – the water wheel spins, creating rotary motion in gear 1 which then drives gear 2
- output – the millstones turn and grind the wheat into flour.

4b.

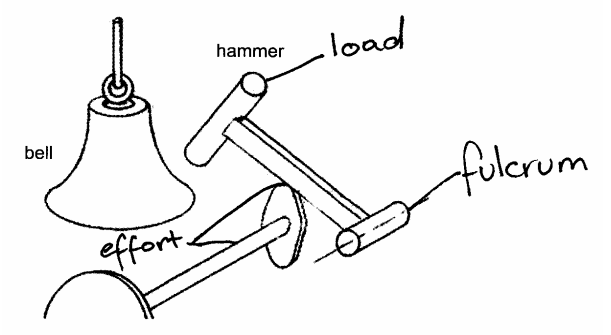
Marks	0	1	Average
%	56	44	**0.5**

Gear 2 turns in a clockwise direction.

4c.

Marks	0	1	2	3	Average
%	19	32	9	40	**1.7**

Students were required to identify the fulcrum, effort and load of the hammer.



4d.

Marks	0	1	2	Average
%	25	27	49	**1.3**

The cam rotation created by the water wheel turning causes the hammer to rise and fall. The action of the hammer falling against the bell causes the bell to sound.

One mark was given for less detailed descriptions than that above.

4e–f.

Marks	0	1	2	3	4	Average
%	23	23	26	19	8	**1.7**

4e.

The rotating shaft supplies the effort to rotate the bell. As the bell rotates, the fulcrum is formed at the junction of the hammer shaft and the bell. The load is on the hammer end as it is raised. As the hammer passes the highest point it falls to sound the bell.

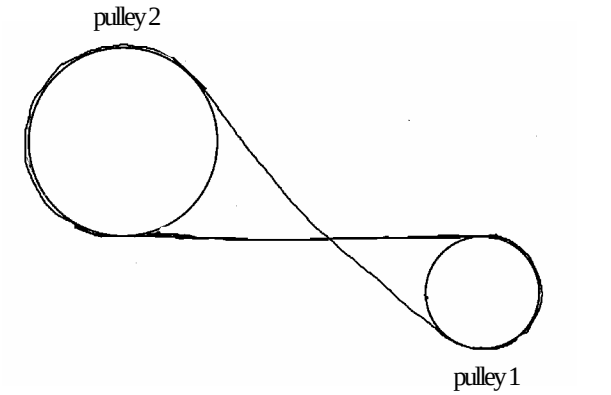
Answers had to use the terms ‘effort’, ‘fulcrum’ and ‘load’ to be awarded three marks. Two marks were given to accurate answers that made mention any of the three terms, and one mark to general descriptions that had some accuracy.

4f.

The motion of the hammer is oscillating.

4g.

Marks	0	1	2	Average
%	52	4	44	**0.9**



4h.

Marks	0	1	2	Average
%	37	25	39	**1.0**

$$\frac{\text{number of revolutions of pulley 1}}{\text{number of revolutions of pulley 2}} = \frac{\text{diameter of pulley 2}}{\text{diameter of pulley 1}}$$

$$\frac{60}{20} = \frac{x}{60}$$

= 180 cm

When calculating the diameter of the pulley, one mark was given for the formula or working and another mark for the correct answer, with or without the unit.

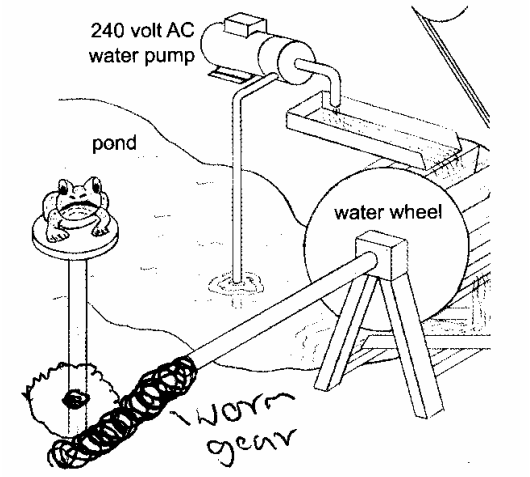
4i.

Marks	0	1	2	Average
%	10	21	69	**1.6**

- Bevel gear – gear D
- Worm gear – gear C

4j.

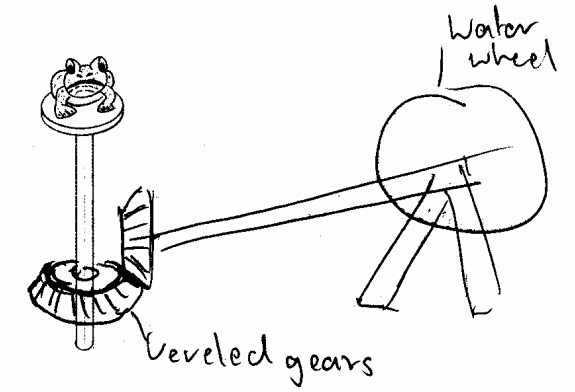
Marks	0	1	2	Average
%	48	14	39	**0.9**



To gain two marks the drawing had to resemble the mechanism driven by the worm gear. Marks were awarded on the basis of how well the drawn gears accurately resembled the work gear and its placement to allow the frog to rotate.

4k.

Marks	0	1	2	3	Average
%	26	17	20	37	**1.7**



This question, which asked students to add a water wheel to Figure 9, required more abstract thought from students and as a result was worth three marks. For three marks, the water wheel had to be drawn from a side elevation, with a shaft, and the bevel gears drawn at 90 degrees. One or two marks were given to less accurate drawings that essentially met the requirements of the question.

Question 5

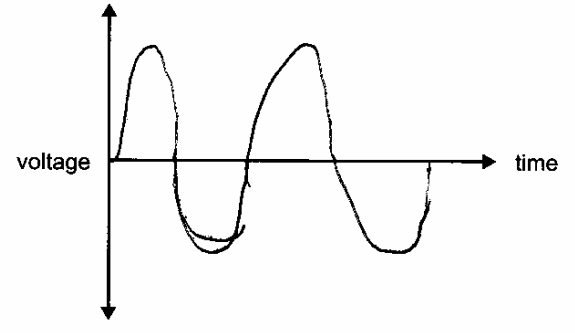
5a.

Marks	0	1	Average
%	29	71	**0.7**

AC stands for alternating current.

5b.

Marks	0	1	2	Average
%	31	22	47	**1.2**



When sketching a typical AC signal, two marks were given to accurate sketches of a sine wave showing two complete cycles, and one mark for less accurate but still recognisable sketches.

5c–e.

Marks	0	1	2	3	4	5	Average
%	19	15	12	27	6	21	**2.5**

5c.

mA stands for milliamperes or milliamps, one 1000th of an amp.

5d.

P = V x I
= 240 x 0.04
= 9.6 watts

One mark was given for the formula or working and a second mark for the correct answer, with or without units.

5e.

$$R = \frac{V}{I}$$
$$= \frac{240}{0.04}$$
$$= 6000R \text{ or } 6K$$

One mark was given for the formula or working and a second mark for the correct answer, with or without units

5f.

Marks	**0**	**1**	**Average**
%	52	48	**0.5**

The logic gate to switch the motor on is an –and gate.

5g.

Marks	**0**	**1**	**2**	**Average**
%	41	6	54	**1.1**

A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

Students had to complete the truth table for the and gate (as shown above). There were no partial marks awarded for this question.

5h.

Marks	**0**	**1**	**2**	**3**	**Average**
%	60	21	11	8	**0.7**

hi.
It is an open loop system.
hii.
Because there is no feedback loop to allow the output to adjust the input.

Less detailed responses were only awarded one mark**.**

5i–l.

Marks	**0**	**1**	**2**	**3**	**4**	**5**	**Average**
%	24	16	15	14	14	16	**2.3**

5i.
The components marked in Figure 11 were:

- A – transformer
- B – transistor.

5j.
The unit of measurement for resistors is ohm(s).

5k.
The unit of measurement for capacitors is farads.

Answers had to be in words, and could have been preceded by ‘pico’, ‘nano’ or ‘micro’.

5l.
Rectification is the changing of alternating current to direct current—AC to DC

5m–n.

Marks	0	1	2	Average
%	30	24	46	**1.2**

5m.

The pair of diodes connected in series is either:

- DI, D2
- D3, D4

No other pairing was correct.

5n.

The type of connection formed by D1, D2 with D3, D4 is parallel.

Question 6

6a–c.

Marks	0	1	2	3	4	Average
%	26	25	22	15	12	**1.7**

6a.

A diode allows current to flow in one direction only.

6b.

An item of test equipment to test the function of a diode could be a:

- multimeter
- ohmmeter
- buzzer
- continuity tester

or a similar response.

6c.

Two marks were given to descriptions that were detailed and relevant to the item of test equipment, or one mark to more basic, but still relevant, descriptions.

6d–e.

Marks	0	1	2	3	Average
%	11	18	19	53	**2.1**

6d.

The percentage of loss is five per cent.

6e.

$$\text{water loss} = \frac{\%\ \text{loss}}{100} \times \frac{\text{water flow}}{1}$$

$$= \frac{5}{100} \times \frac{5}{1}$$

$$= 250\text{ml}$$

One mark was given for the formula or working, and one mark for the correct answer.

6f.

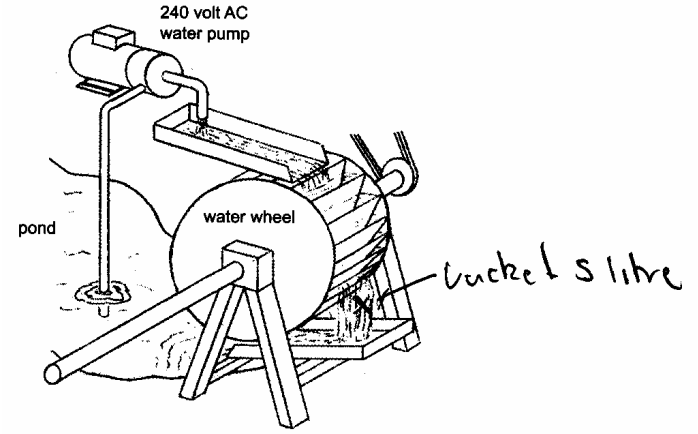
Marks	0	1	2	Average
%	40	29	31	**0.9**

Two items of test equipment to test the efficiency rating are:

- a timing device
- a graded measuring device.

6g.

Marks	0	1	2	Average
%	51	10	40	**0.9**



Students were asked to indicate where one item of test equipment would be placed.

Question 7

7a.

Marks	0	1	2	Average
%	23	30	47	**1.3**

Two factors that would contribute to the loss of water when the water wheel is operating include:

- evaporation
- splashing.

7b.

Marks	0	1	Average
%	26	74	**0.8**

An environmental disadvantage of using the system could be that when using a garden hose there is no means of recycling the water.

7c.

Marks	0	1	Average
%	58	42	**0.4**

A major environmental disadvantage of using an electrical mains powered pump is that the generation of the power will create some sort of environmental problem.