Neap:

Trial Examination 2008

VCE Physics Unit 2

Written Examination

Question and Answer Booklet

Reading time 15 minutes
Writing time 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Section	Number of questions	Number of questions to be answered	Number of marks
A Core – Areas of study			
1. Movement	16	16	34
2. Electricity	15	15	30
B Detailed studies			
1. Astrophysics	13	13	26
OR			
2. Aerospace	13	13	26
OR			
3. Alternative energy sources	13	13	26
			Total 90

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, up to two pages (one A4 sheet) of pre-written notes (typed or handwritten) and one scientific calculator.
Students are NOT permitted to bring into the examination room: blank pieces of paper and/or white out liquid/tape.

Materials supplied

Question and answer booklet of 23 pages including a removable data sheet in the centrefold.

Answer sheet for multiple-choice questions.

Instructions

Please ensure that you write your **name** and your **teacher's name** in the space provided on this booklet and on the answer sheet for multiple-choice questions.

Always show your working where space is provided.

Where an answer box has a unit printed in it, give your answer in that unit.

All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other electronic communication devices into the examination room.

SECTION A – CORE

Instructions for Section A

Answer **all** questions **for both** Areas of study in this section of the paper.

You should take the value of g to be 10 m s^{-2}.

Area of study 1 – Movement

Britney and Brett launch a "water-powered" rocket using a fizzy drink bottle half filled with water. It flies straight up in the air directly after the launch from rest position.

Figure 1 shows the velocity–time graph of the motion of the rocket for the 14 seconds directly after the launch. Air resistance is minimal and is therefore ignored in Questions 1 to 4. The scale on the vertical axis has been omitted.

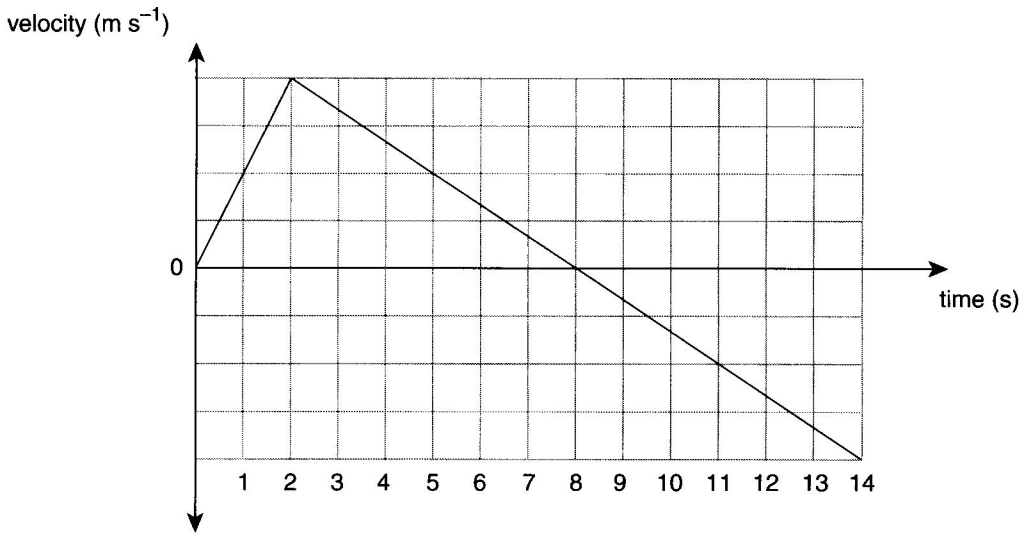

Figure 1

Question 1

Without referring to the magnitude of the velocity, describe the journey of the rocket between:

a. 0 and 8 seconds.

_____

_____

_____

2 marks

b. 8 and 14 seconds.

_____

_____

1 mark

Question 2

Assuming that the rocket falls freely through the air on the way down, calculate the greatest velocity achieved by the rocket. Show all your working.

m s^{-1}	3 marks

Question 3

Calculate the maximum height the rocket reached during its flight.

m	2 marks

Question 4

Will the rocket reach the ground after 14 seconds? Support your answer with a calculation.

	3 marks

Next, Brett and Britney attach a parachute to the rocket and launch it again.

The parachute opens correctly and, as the rocket falls down, it soon reaches a uniform, terminal velocity.

Question 5

Explain, in terms of the forces acting on the rocket and parachute, how a constant downward velocity is achieved.

2 marks

Question 6

In the text below, options are given in bold. Indicate your choice of the best option by circling it.

According to Newton's [**first / second / third**] law, any force always has an accompanying reactive force. The force of gravity acting on you while you stand on the ground is called [**weight / mass / heavy**] force. The reaction force to this gravitational force is [**you pulling up the Earth / the ground holding you up / the ground pushing your feet**].

3 marks

Jack Sparrow, the famous pirate, climbs on the rigging of his ship as shown in Figure 2 below.
Two forces, *A* and *B*, have been identified as acting on Jack.

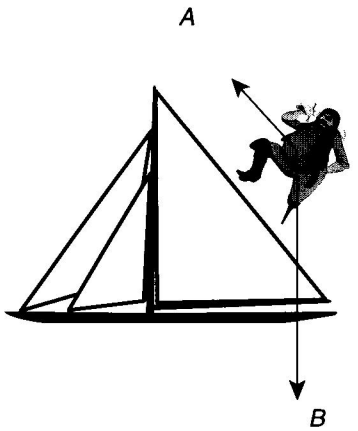

Figure 2

Question 7

Assuming that Jack is stationary, are any forces other than *A* and *B* acting on him?
Explain your answer.

2 marks

Question 8

Jack has a mass of 79 kg. Calculate the magnitude of force *B*.

N

1 mark

The angle between forces A and B is 120°.

Question 9

Use the space below to calculate the magnitude and direction of force A.

N	Direction:

3 marks

Unfortunately, Jack falls from the webbing during a sword fight. He falls 5.0 m to the deck of the boat. As he does so, gravity does work on Jack.

Question 10

Calculate the amount of work done on Jack as he falls 5.0 m.

J

2 marks

Question 11

The work done by gravity transforms

A. kinetic energy into gravitational potential energy.
B. gravitational potential energy into heat energy.
C. gravitational potential into kinetic energy.
D. heat energy into gravitational potential energy.

2 marks

Luckily, Jack falls onto a soft mattress and as a result gets a soft landing, stopping at the level of the deck. The mattress is compressed by a maximum amount of 0.20 m as Jack lands.

Question 12

Calculate the spring constant k of the mattress that Jack lands on.

$N m^{-1}$

2 marks

Question 13

Show that the average force experienced by Jack during his landing is about 20 000 N.

2 marks

Legend has it that Galileo dropped objects of varying mass off the tower of Pisa to measure their falling times. Amongst these objects might have been two iron balls: a cannon ball of 1.0 kg and a musket ball of 0.010 kg.

Question 14

What would Aristotle have predicted about the falling time of these two balls?

1 mark

Question 15

What did Galileo observe after doing the experiment?

1 mark

Question 16

How did Newton explain Galileo's observation?

2 marks

END OF AREA OF STUDY 1

Area of study 2 – Electricity

Use the circuit in Figure 1 to answer the following questions.

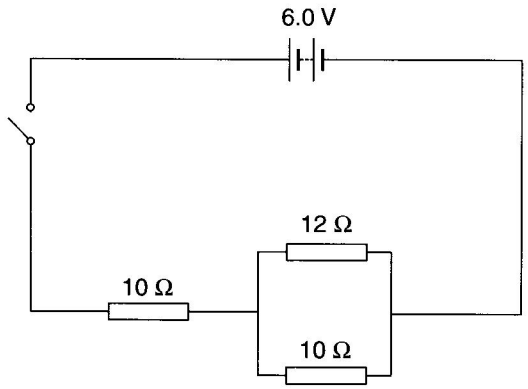

Figure 1

Question 1

What is the total resistance of the circuit?

Ω	2 marks

Question 2

What is the expected total current?

mA	2 marks

Question 3

What is the power consumed by this circuit?

W	2 marks

Question 4

If the circuit is left on for 1.5 minutes how much charge flows through it?

C

2 marks

Question 5

What is the energy used by the circuit in this time?

J

2 marks

Figure 2 below shows the current versus voltage for two electrical devices. The two devices are placed in parallel and the current measured through R_1 is 600 mA.

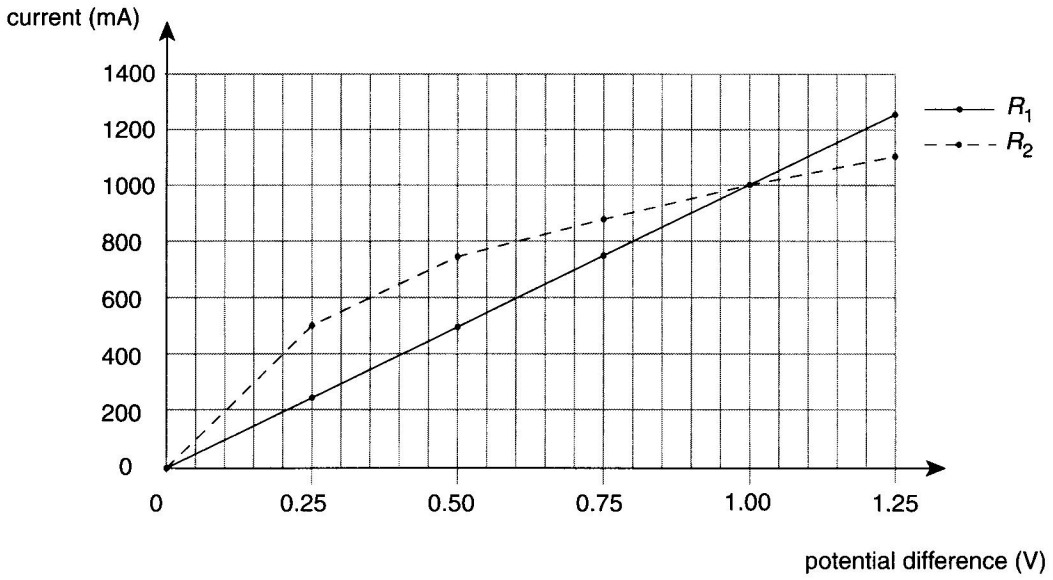

Figure 2

Question 6

The potential difference across R_2 is

A. 0.6 V
B. 0.36 V
C. 0.96 V
D. 1.2 V

2 marks

Question 7

The power used by R_2 is

A. 0.6 W.
B. 0.75 W.
C. 0.8 W.
D. 0.48 W.

2 marks

Greg finds an unknown electronic device in his dad's shed. He wires up the device as shown in Figure 3. He increases the voltage slowly and he notices that there is no current reading until he reaches a voltage of 0.7 V. When he reverses the ends of the device no current flows, no matter how high he sets the voltage.

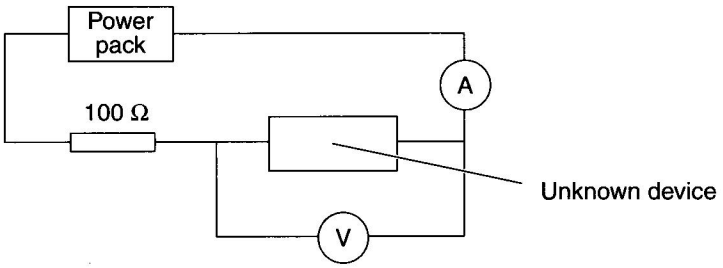

Figure 3

Question 8

The device that Greg has found is most likely to be

A. a fuse.
B. a resistor.
C. a diode.
D. a temperature-dependent resistor.

2 marks

Question 9

Why did Greg place a resistor in the circuit with the unknown device?

1 mark

Question 10

The power pack is set to 9 V. Determine the power used by the circuit.

W

2 marks

Question 11

Greg's dad comes into the shed when Greg is not around. He sees the setup and then decides to wire up the device as shown in Figure 4.

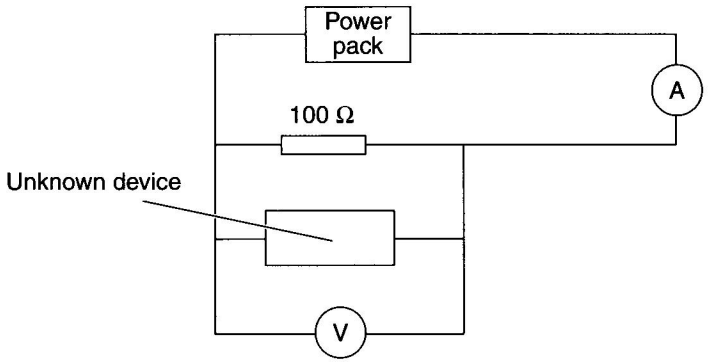

Figure 4

However when he turns on the power to 2 V there is a short flash and the device is 'burnt out'.

Explain what happened to the device.

2 marks

Question 12

Greg wires up the resistor to an AC supply. Sketch below how an AC voltage would look compared to a DC. You do not need to specify values.

2 marks

Question 13

In the text below, options are given in bold. Indicate your choice of the best option by circling it.

In domestic power supply 240 V is the [**AC / DC / amp**] equivalent in terms of power consumption. For an appliance with a metal casing the wiring of a plug needs to contain [**an earth / a fuse / a neutral**] to prevent the casing from becoming live. The main purpose of [**an earth / a fuse / a neutral**] is to prevent excessive current from flowing through a circuit and potentially causing a fire.

3 marks

Question 14

Electric shock affects the body's nervous system and can have severe consequences. Explain two possible factors that can increase the severity of an electric shock.

2 marks

Question 15

Georgina has a 10 A heater in her bathroom. She uses it every day during one week for 20 minutes. How much energy has been consumed?

kW h

2 marks

END OF AREA OF STUDY 2

SECTION B – DETAILED STUDIES

Instructions for Section B

Choose **one** of the following **Detailed studies**. Answer **all** the questions on the Detailed study you have chosen.

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 2, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

Detailed study 1 – Astrophysics

Question 1

Which of the following can be considered the key difference between the steady state and the big bang theories in cosmology?

A. The big bang theory has more evidence in support of it than the steady state theory.
B. The big bang theory says the universe is static, while the steady state theory says it is changing.
C. The big bang theory says the universe is expanding, while the steady state theory says it is static.
D. Both theories say the universe is expanding but only the big bang theory says it is becoming less dense as a result.

Question 2

Which of the following is the force that is most important in forming the universe on a large scale?

A. Gravity
B. Electromagnetic
C. Strong nuclear
D. Weak nuclear

Question 3

Which of the following best describes the diameter of the Milky Way galaxy?

A. 100 parsec
B. 100 light years
C. 100 000 light years
D. 100 million parsec

Question 4

In the Hertzsprung–Russell diagram most stars are found in a large group called

A. red giants.
B. white dwarfs.
C. black holes.
D. the main sequence.

Questions 5 to 7 refer to Figure 1. It shows a representation of the Hertzsprung–Russell diagram.

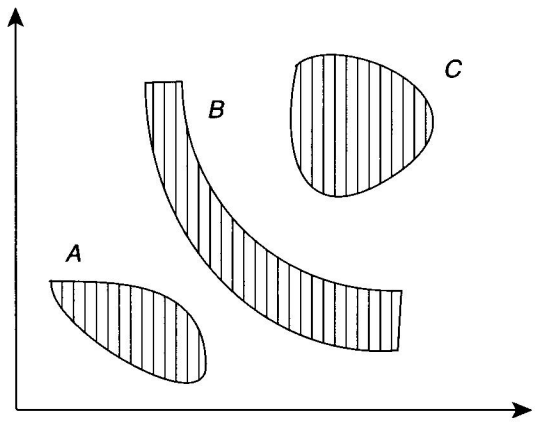

Figure 1

Question 5

Which of the following would be a good label for the vertical axis?

A. Luminosity
B. Absolute brightness
C. Total power output
D. All of the above would be suitable.

Question 6

In which of the regions, *A*, *B* or *C*, would the Sun be found on the Hertzsprung–Russell diagram?

A. *A*
B. *B*
C. *C*
D. The Sun is not on this diagram.

Question 7

What property of stars is represented by the horizontal axis?

A. Temperature
B. Mass
C. Colour
D. Diameter

Question 8

For his discovery of Hubble's law, Edwin Hubble measured the speed of which objects?

A. Stars
B. Planets
C. Galaxies
D. Comets

Question 9

Which quantity other than the one mentioned in Question 8 did Hubble measure?

A. Mass
B. Temperature
C. Parallax
D. Distance

Question 10

The Doppler effect for light means that when a source of light is moving towards you

A. its light has an increased wavelength and increased speed.
B. its light has a decreased wavelength and decreased speed.
C. its light has an increased wavelength and unchanged speed.
D. its light has a decreased wavelength and unchanged speed.

Question 11

Earth's own Milky Way galaxy is an average-sized

A. spiral galaxy.
B. elliptical galaxy.
C. globular galaxy.
D. irregular galaxy.

Question 12

The massive amount of energy emitted by stars is mostly generated by

A. hydrogen undergoing nuclear fission.
B. hydrogen undergoing nuclear fusion.
C. helium undergoing nuclear fusion.
D. helium undergoing nuclear fission.

Question 13

Figure 2 shows how astronomers might use parallax to measure the distances between Earth and nearby stars.

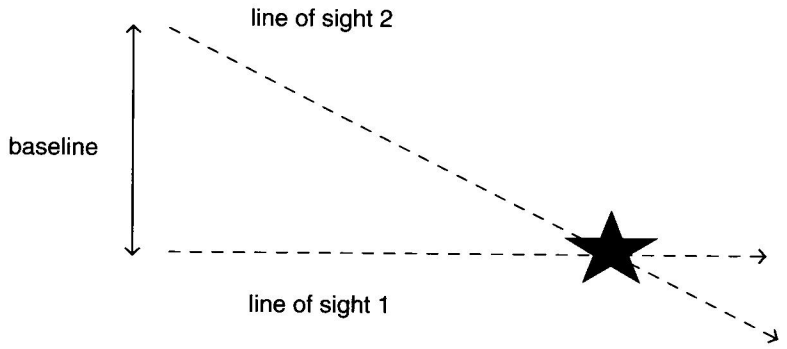

Figure 2

In this situation, the baseline must be at least

A. 1 meter long.

B. 1 kilometer long.

C. 1 astronomical unit long.

D. 1 light year long.

END OF DETAILED STUDY 1

Detailed study 2 – Aerospace

Question 1

An aircraft experiences four main forces during flight. These forces are

A. lift, air resistance, weight, drag.
B. drag, weight, thrust, gravity.
C. lift, drag, thrust, weight.
D. drag, normal force, thrust, weight.

For Question 2 and Question 3, refer to Figure 1 below. The arrows **A–D** represent forces.

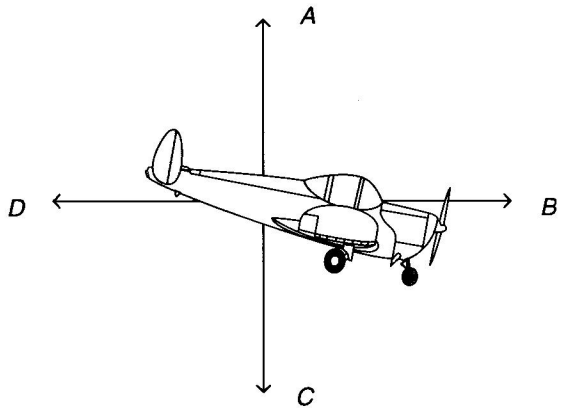

Figure 1

Question 2

For an aircraft slowing down and losing altitude to land, which of the following best represents the likely balance between the forces acting in the aircraft?

A. *A* is equal to *C*, *B* is equal to *D*.
B. *A* is bigger than *C*, *D* is bigger than *B*.
C. *A* is smaller than *C*, *B* is bigger than *D*.
D. *A* is smaller than *C*, *D* is bigger than *B*.

Question 3

For an aircraft travelling at a constant speed and altitude, which of the following best represents the likely balance between the forces acting on the aircraft?

A. *A* is equal to *C*, *B* is equal to *D*.
B. *A* is bigger than *C*, *D* is bigger than *B*.
C. *A* is smaller than *C*, *B* is bigger than *D*.
D. *A* is smaller than *C*, *D* is bigger than *B*.

Question 4

For stability, the upward force acting on a flying aircraft must act as close as possible to its

A. wings.
B. tail.
C. centre of gravity.
D. cargo area.

Question 5

If the upward and downward forces on a flying aircraft are equal but do not act on the same point of action, the aircraft will most likely

A. crash.
B. start to rotate.
C. lose altitude.
D. None of the above.

Question 6

Bernoulli's theory helps to explain how aeroplanes generate lift by

A. changing the direction of airflow around the wings.
B. changing the pressure above and below the wing surface.
C. balancing weight and lift.
D. changing the angle of attack of the wing.

Question 7

Which of the following can also be used to explain lift?

A. Conservation of energy
B. Conservation of mass
C. Conservation of momentum
D. None of the above.

Questions 8 to 11 refer to the information below.

Josh and Julia are working on a simulation experiment using a wing profile, a force meter and a simple wind tunnel. Their experiment is shown in Figure 2.

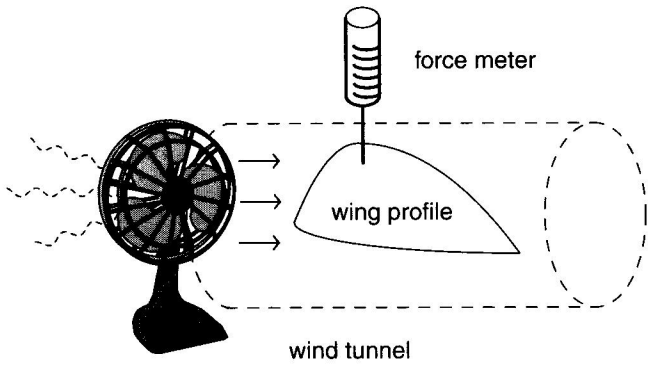

Figure 2

Question 8

Which aspect of flight is simulated by the moving air in the wind tunnel?

A. The forward motion of the aircraft wing through the air.
B. The backward motion of the wing through the air.
C. The windy weather during the flight.
D. The lift force generated by the wing.

Question 9

The wing profile is suspended from a fixed force meter as shown in Figure 2. When the fan is turned off, the scales read 20 N. Now the fan is turned on.

What will happen to the reading on the force meter?

A. It will now read 0 N.
B. It will now read more than 20 N.
C. It will now read less than 20 N.
D. There will be no change to the reading.

Question 10

During the experiment the wing profile also experiences drag forces. These forces are mostly caused by

A. rolling friction and static friction.
B. skin friction and pressure drag.
C. pressure drag and sliding friction.
D. skin friction and static friction.

Question 11

Which arrow best indicates the direction of the drag forces on the wing profile?

A. → (right)
B. ← (left)
C. ↑ (up)
D. ↓ (down)

Questions 12 and 13 refer to the information below.

An aeroplane is fitted with two propellers, one on each wing. Each one provides 2000 N of thrust at full power. The propellers are fitted 5.0 m from the plane's centre of mass. This situation is shown in Figure 3.

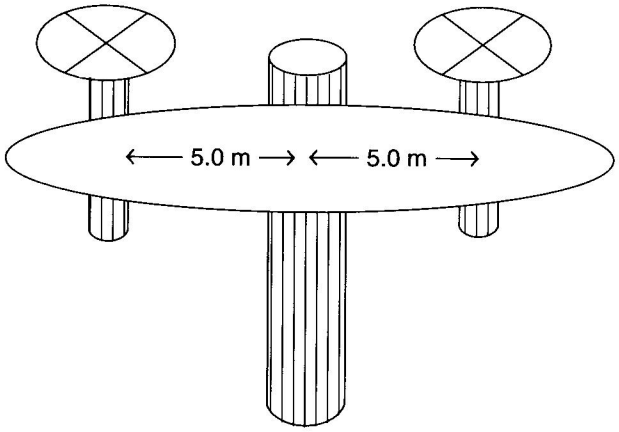

Figure 3

Question 12

The torque generated around the plane's centre of mass at full power by one of these engines is

A. 2000 N m
B. 10 000 N m
C. 400 N m
D. 0 N m

Question 13

When both engines work at full power, the total torque generated is

A. 4000 N m
B. 20 000 N m
C. 800 N m
D. 0 N m

END OF DETAILED STUDY 2

Detailed study 3 – Alternative energy sources

Question 1

Alex notes that his AC adapter for his laptop has input values of 240 V, 1.5 A, and output values of 20 V, 3.25 A. The efficiency of the adapter, in terms of power consumption, is

A. 8.3%
B. 18%
C. 46%
D. 100%

Question 2

The energy difference between input and output is lost as

A. mechanical energy.
B. light energy.
C. heat energy.
D. electrical energy.

Question 3

During winter, a solar panel's ability to generate electricity is affected because

A. there is more windy weather on average than in summer.
B. the daytime temperature is lower on average than in summer.
C. the tilt of the Earth's axis means that the solar radiation must travel a greater distance through the Earth's atmosphere.
D. the Sun's overall radiation output declines during winter.

In 2005 Australia's electricity capacity was estimated to be 50.6 gigawatts (GW), of which the majority is carbon-based.

Question 4

The Victorian government uses "black balloons" as a way of visually representing greenhouse gases. One balloon is approximately 50 grams of greenhouse gas. Electricity use for lighting in an average Victorian home generates 20 000 black balloons per year. This is equivalent, in terms of greenhouse gases, to

A. 1 tonne
B. 1×10^3 tonnes
C. 1×10^6 tonnes
D. 1×10^9 tonnes

Question 5

Use the information provided in Question 4 to answer this question.

One energy-saving technique is to replace incandescent globes with energy efficient fluorescent globes. Assuming a house uses 75 W globes and replaces them with 15 W globes, the reduction in number of black balloons in one year is

A. 4000
B. 16 000
C. 18 000
D. 20 000

Question 6

In Victoria our energy is principally derived from [**natural gas / nuclear fuel / coal**]. This produces energy but also may be contributing to what is commonly called [**the greenhouse effect / pollution / the ozone hole**]. Scientists believe this is [**causing a decrease in / having no effect on / causing an increase in**] the Earth's atmospheric temperature.

The correct sequence is:

A. nuclear fuel / greenhouse effect / causing a decrease
B. coal / greenhouse effect / causing an increase
C. solar / ozone hole / causing a decrease
D. coal / contamination / causing a decrease

Question 7

One alternative energy supply uses a very large tower with a wide base. Infrared radiation from the sun heats up the air in the base area which rises and drives a turbine inside the tower to generate electricity. The energy transformations mentioned above in sequence are:

A. Electrical → Radiant heat from the sun → Mechanical
B. Radiant heat from the sun → Electrical → Mechanical
C. Radiant heat from the sun → Mechanical → Electrical
D. Mechanical → Radiant heat from the sun → Electrical

Question 8

On March 29th 2008, Melbourne participated in an event called Earth Hour. People and businesses turned off their lights for one hour. This reduced electrical consumption by approximately 10%. If Melbourne's base load supply is approximately 2100 MW, how much energy in GJ was saved in that hour?

A. 210
B. 0.756
C. 58
D. 756

Question 9

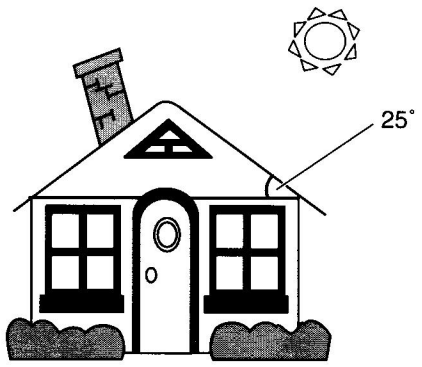

Figure 1

Ideally, to capture the maximum amount of solar energy, the solar panels would be adjustable in order to track the path of the sun though the sky. However, generally when a solar panel is placed on a roof it is in a fixed position. At what angle does the sun have to be with respect to the horizontal in Figure 1 so that the fixed panel receives the maximum amount of solar energy?

A. 0°
B. 90°
C. 65°
D. 25°

Question 10

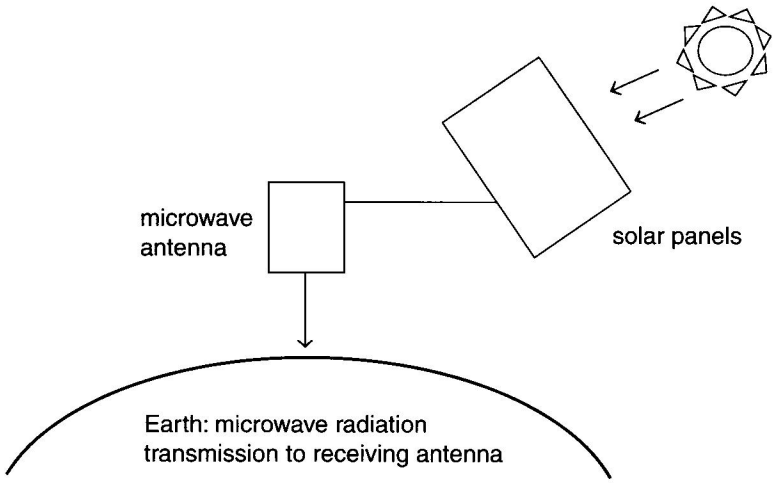

Figure 2

One proposal for renewable energy is to construct an orbiting solar power station. Solar panels would collect energy which would be transmitted to Earth via microwave radiation as shown in Figure 2. Victoria's base power needs are approximately 2100 MW. Assuming a rate of solar radiation above the Earth's atmosphere of 1.37 kW m^{-2} and an overall efficiency of the system of 12.0%, then the area required for the solar panels would be (in m^2):

A. 2100
B. 1.53×10^6
C. 1.28×10^7
D. 1.14×10^4

Question 11

In NSW the Snowy Mountains are used to provide hydroelectric energy. The water is held in a dam and it can then fall through a shaft to drive a turbine. One of its power stations (Tumut 3) has a "rated head" of 150.9 metres. Given that $g = 10\ m\ s^{-2}$, the density of water is $1.0\ kg\ L^{-1}$ and 1 tonne = 1000 kg, the amount of stored energy per tonne of water is potentially

A. 0.15 MJ

B. 1.5 MJ

C. 1.5×10^3 MJ

D. 1.5×10^2 MJ

Question 12

The reason that not all the potential energy is converted to useful energy is

A. bad design.

B. low availability of water due to drought.

C. unavailability of turbines due to breakdown and repairs.

D. energy loss in system.

Question 13

Read the following and decide which statement is **incorrect**. Australia has the largest uranium deposits in the world. The reason why uranium is not considered a viable alternative energy source for Australia is

A. there are concerns about its greenhouse emissions.

B. there are concerns about the consequences of an accident at a nuclear power plant.

C. there are concerns about storage of its waste.

D. there are concerns about the cost of building and maintaining a nuclear power plant.

END OF QUESTION AND ANSWER BOOKLET