2/10+2

Physics Year 11

Semester Two Revision paper 2021

Question/Answer Booklet

PHYSICS

Name:_____

Teacher:_____

Time allowed for this paper

Reading time before commencing work: Ten minutes

Working time for paper: Three hours

Material required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet

Physics: Formulae, Constants and Data Sheet

To be provided by the candidate

Standard Items: Pens, pencil, eraser, correction fluid, ruler, highlighter

Special Items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course, drawing templates, drawing compass and a protractor

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Short response	15	15	50	54	30
Section Two: Problem-solving	6	6	90	90	50
Section Three: Comprehension	2	2	40	36	20
				Total	**100**

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2032.* Sitting this examination implies that you agree to abide by these rules.

2. Write answers in this Question/Answer Booklet.

   When estimating numerical answers, show your working or reasoning clearly. Give final answers to a maximum of two significant figures and include appropriate units where applicable.

4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question. Are you reading this?

5. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

SECTION ONE: Short Response

30% (54 marks)

This section has 15 questions. Answer all questions.

When calculating numerical answers, show your working or reasoning clearly. Give final answers to **three** significant figures and include appropriate units where applicable.

When estimating numerical answers, show your working or reasoning clearly. Give final answers to a maximum of **two** significant figures and include appropriate units where applicable.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 50 minutes.

Question 1

(4 marks)

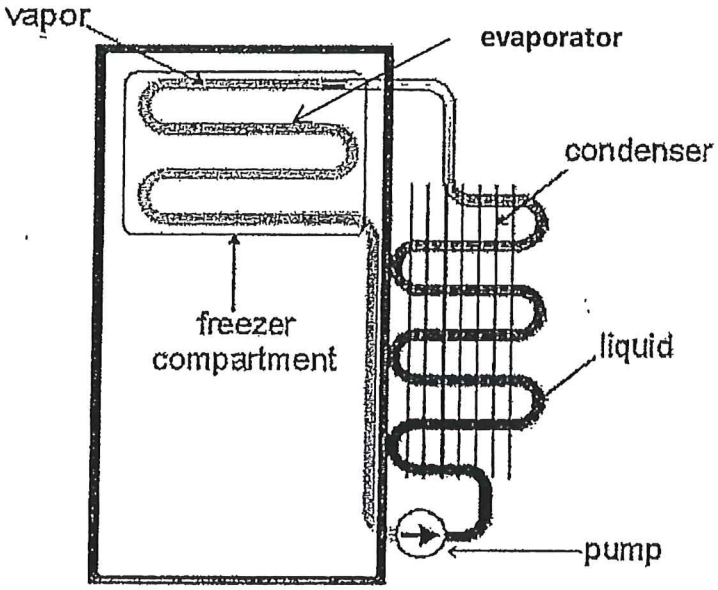
Distinguish between the concepts of ***internal energy*** and ***temperature***.

Internal energy is... the sum of the kinetic energy and potential energy of the particles in that substance.

Temperature is.. a measure of the average kinetic energy of the particles in a substance

Question 2 **(3 marks)**

The diagram below shows the main parts of a refrigerator. Describe the phase change that takes place within the evaporator and within the condenser and **explain their role in cooling the contents of the freezer compartment.**



Evaporator... THE REFRIGERANT CHANGES FROM A LIQUID TO A GAS. (1/2) HEAT IS TRANSFERED FROM THE AIR (1/2) IN THE FREEZER COMPARTMENT TO THE GASEOUS REFRIGERANT.

* MENTION OF HEAT TRANSFERED TO THE REFRIGERANT ⇒ ↑I.E IS O.K

Condenser...

GAS → LIQUID (1/2)

HEAT IS TRANSFERED TO THE SURROUNDING AIR. (1/2)

The overall role of the evaporator and the condenser is to.....

TRANSFER HEAT FROM THE INSIDE OF THE REFRIGERATOR TO THE AIR OUTSIDE OF THE FRIDGE. (1)

$Q_{INSIDE} \Rightarrow Q_{OUTSIDE}$

NOTE Will not accept absorbing heat energy from freezer causes the phase change to occur.

3

Question 3 **(4 marks)**

For the following statements, indicate whether they are true (T) or false (F).

(a) Heat cannot transfer through a vacuum F

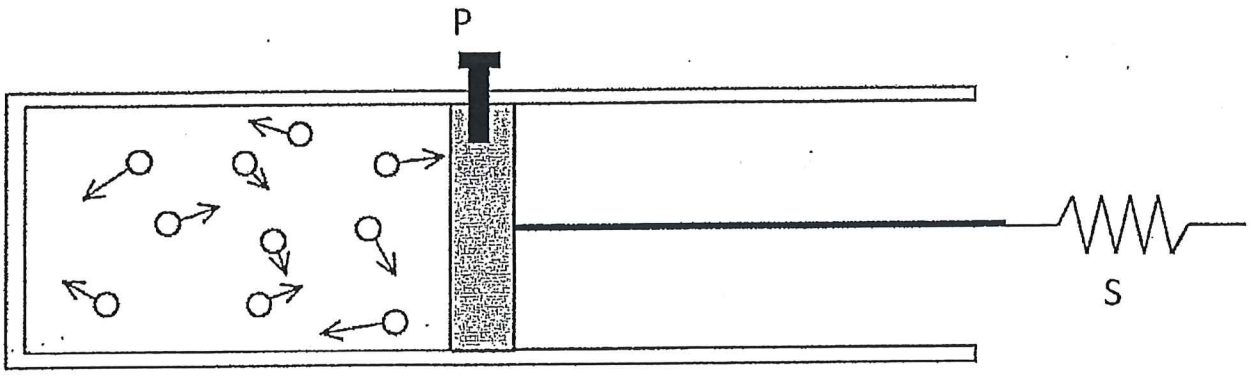
(b) Temperature is a measure of the total energy of the particles in a substance F

(c) At 0 K, particles have no kinetic energy T

(d) If two materials are in thermal equilibrium, they have the same internal energy F

Question 4 **(3 marks)**

The diagram below shows molecules of a hot gas in a cylinder. The piston is held in place a by a pin P and the cylinder is thermally insulated.



When the pin is removed, the piston moves to the right and in doing so, compresses the small spring, S. Explain how the temperature of the gas in the cylinder changes, making clear reference to changes in the *internal energy* of the gas.

$\downarrow E_{KAV} \Rightarrow \downarrow T \Rightarrow \downarrow E_K \Rightarrow \downarrow I.E$

- AS THE GAS VOLUME INCREASES, THE PRESSURE DECREASES AND SO DOES THE E_{KAV} (1) OF THE MOLECULES AND THUS, THE GAS TEMP. (1) DECREASES.
- A REDUCTION IN OVERALL KINETIC ENERGY OF THE MASS OF GAS CAUSES A REDUCTION IN THE GAS' INTERNAL ENERGY. (1)

$E_K \downarrow$ 1 mark

$T \downarrow$ 1 mark $E_T \downarrow$ 1 mark. 7/7

Question 5 **(3 marks)**

Stable nuclei with a mass number greater than 20, contain more neutrons than protons. With reference to the ***strong nuclear force*** and the forces of ***electrostatic repulsion***, suggest an explanation for this observation. $\Sigma F_{nn} > \Sigma F_{p\text{-}p}$

NEUTRONS (Do / Not) HAVE AN ELECTROSTATIC REPULSION AS THEY HAVE ZERO CHARGE. HOWEVER THEY EXHIBIT A SHORT RANGE ATTRACTIVE (1) FORCE BETWEEN NUCLEONS (protons + neutrons).

A NUCLIDE/ATOM IS STABLE IF THE n:p RATIO IS SUCH THAT $\Sigma F_{nn} > \Sigma F_{p\text{-}p}$ OR $\Sigma F_{\text{NUCLEAR}}$ (1) $> \Sigma F_{\text{ELECTRO REPULSION}}$

Question 6 **(4 marks)**

State and describe the operation of two safety features of a nuclear reactor:

Feature 1: CONTROL RODS (1)

Description of operation:

- CONTROL RODS ABSORB NEUTRONS
- LOWERED CONTROL RODS SLOW THE RATE OF THE FISSION OF ATOMS.

Feature 2: CONTAINMENT BUILDING OR (1) SHIELDING.

Description of operation:

THE CONTAINMENT BUILDING MADE FROM STEEL REINFORCED CONCRETE ABSORBS (1) BOTH HIGH SPEED NEUTRONS AND HIGH ENERGY GAMMA RADIATION, THUS SHIELDING HUMANS FROM ANY STRAY, HARMFUL RADIATION.

- OTHER FEATURES – FILM BADGES, TLDs, BACK UP PUMPS (DOUBLE & TRIPLE REDUNDANCIES), FROZEN PLUGS ETC.

/1

ıion 9 **(4 marks)**

plain clearly the difference between a scalar and a vector quantity, giving one example of each.

Scalar: - HAS MAGNITUDE ONLY eg MASS, SPEED, TIME (1) (1)

Vector:- HAS MAGNITUDE AND DIRECTION eg FORCE, VELOCITY, MOMENTUM (1) (1)

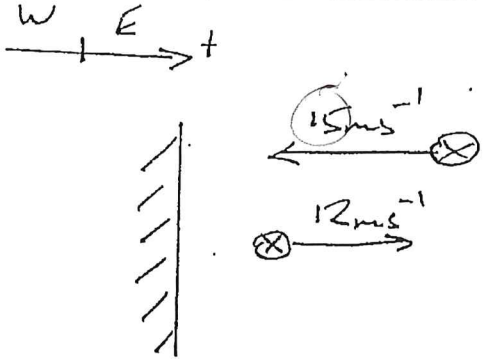
Question 10 **(4 marks)**

A ball is thrown west at 15 m s^{-1} and hits a wall. It rebounds at 12 m s^{-1}. Find the **change** in velocity of the ball and state clearly whether or not the collision with the wall is elastic or inelastic.

Elastic or (Inelastic Collision) **(circle the correct answer).** (1)

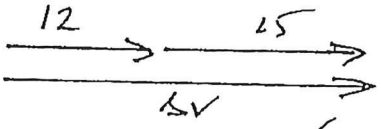
Show the calculation for the change in velocity below.

SITUATION DIAGRAM



VECTOR DIAGRAM

$\Delta v = v - u$ (1)



$\therefore \Delta v = 12 - (-15)$

$= 27.0 \text{ ms}^{-1} \rightarrow$

(1) OR EAST (1)

NOTE: DIAGRAMS ARE NOT REQUIRED ... BUT THEY ARE A GOOD IDEA!

*MINUS (1/2) IF NO DIRECT.

INELASTIC (COLLISION): — AS THE REBOUND KINETIC ENERGY IS LESS THAN THE INITIAL KINETIC ENERGY. (1)

8 OR SIMILAR WORDING/CALCS.

/0

OTHER DEVICES
× RCDs
× DOUBLE INSULATION

Question 7 (4 marks)

State and describe the operation of two electrical safety devices:

Feature 1: FUSE (1) (SEE LIST OF DEVICES ABOVE)

Description of operation:

IF A CIRCUIT OR COMPONENT IS DRAWING AN EXCESSIVE CURRENT, THEN THE FUSE WILL OVER HEAT AND GO OPEN CIRCUIT (1), THUS STOPPING THE FLOW OF HIGH CURRENT.

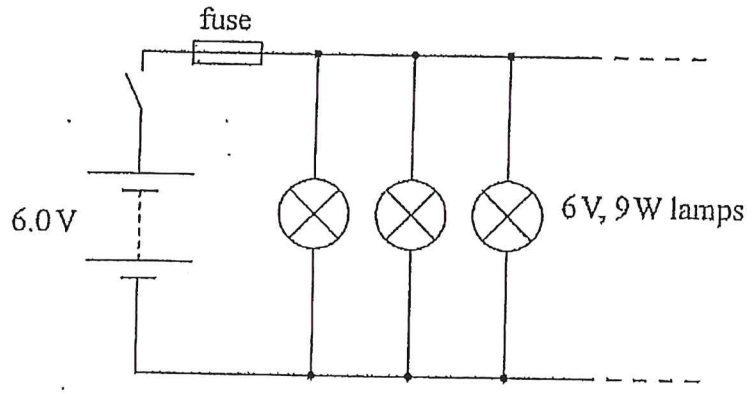
Feature 2: EARTH WIRE (1)

Description of operation:

THE EARTH WIRE PROVIDES A PARALLEL PATHWAY FOR ELECTRICITY IN THE EVENT OF ELECTROCUTION (1). THE EARTH WIRE HAS A LOW RESISTANCE.

Question 8 (4 marks)

A low vltage lighting circuit is set up so that additional light bulbs can be added in parallel. Each light bulb is rated at 6 V, 9 W.



The fuse is rated at 13 A. This means the fuse will "blow" if the total current through the circuit exceeds 13 A. When the switch is closed in the above circuit, determine the maximum number of 6V,9W light bulbs that can be added in parallel without the fuse blowing.

FOR MAX CURRENT PER LAMP

$I = \frac{P}{V}$ (1)

$= \frac{9}{6}$

$= 1.5\,A$ (1)

FOR MAX NO: LAMPS

$N = \frac{13}{1.5}$

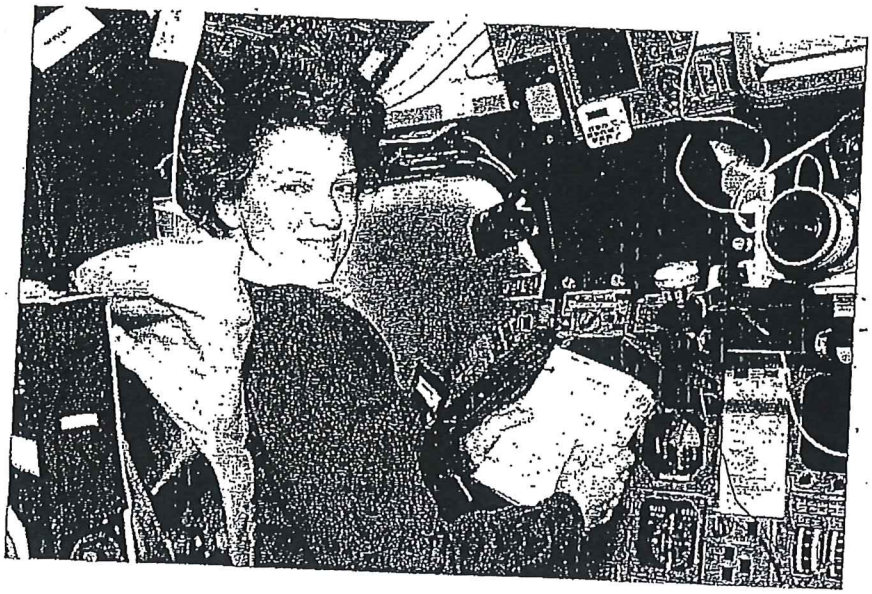
$= 8.66$ LAMPS (1)

∴ 8 LAMPS MAX (1)

Question 11

(3 marks)

Eloise is sitting in the cockpit of a spaceship in "deep space". This means that she can see nothing but darkness when looking out of the windows.



Would Eloise be able to notice whether or not her spaceship is accelerating?

(Yes) No (circle the correct answer) (1)

Explain your answer below.

AS THE SPACESHIP ACCELERATES, ELOISE'S BODY WOULD FEEL THE SEAT AND OR, THE COCKPIT PUSH (1) INTO HER. (ELOISE' BODY HAS INERTIA AND WOULD RESIST ANY CHANGE (1) IN VELOCITY (NEWTON'S 1ST LAW)).

OR

[ELOISE MAY ALSO OBSERVE Loose OBJECTS APPEAR TO MOVE ACROSS THE COCKPIT (LOOSE PENS ETC)).]

↑ ALSO (1) MARK.

TOTAL MARKS (3) ONLY.

3

Question 11 **(3 marks)**

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Would Eloise be able to notice whether or not her spaceship is accelerating?

(Yes) / No (circle the correct answer) (1)

Explain your answer below.

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OR

[ELOISE MAY ALSO OBSERVE Loose OBJECTS APPEAR TO MOVE ACROSS THE COCKPIT (LOOSE PENS ETC).]

↑ ALSO (1) MARK

TOTAL MARKS (3) ONLY.

3

$m_1 = 1.80\,kg$ $V_{comb} = ?$

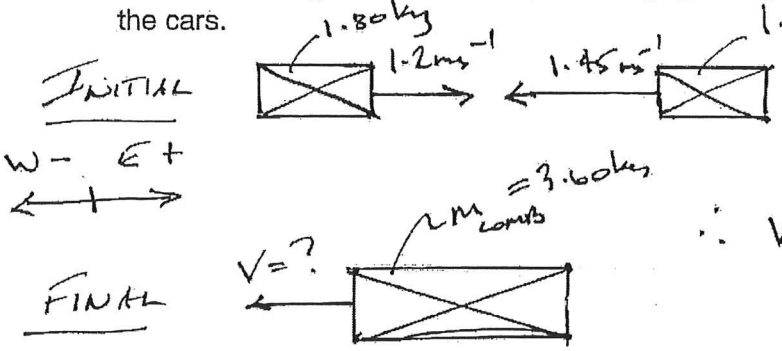
$m_2 = 1.80\,kg$

$u_1 = 1.20\,ms^{-1}$

$u_2 = -1.45\,ms^{-1}$

Question 12 **(4 marks)**

A model car of mass 1.80kg is travelling at 1.45 m s^{-1} westerly on a straight track. It collides with an oncoming car of the same mass, travelling at 1.20 ms^{-1} in the opposite direction. After the collision, the cars lock together and continue moving. Ignoring the effects of friction, find the final velocity of the cars.



$\Sigma p_i = \Sigma p_f$ (1)

$(m_1u_1) + (m_2u_2) = m_{comb}V$

$\therefore V_{comb} = \dfrac{(1.80 \times 1.20) + (1.80 \times -1.45)}{3.60}$ (2.16 (1), −2.61 (1))

$= \dfrac{2.16 - 2.61}{3.60}$

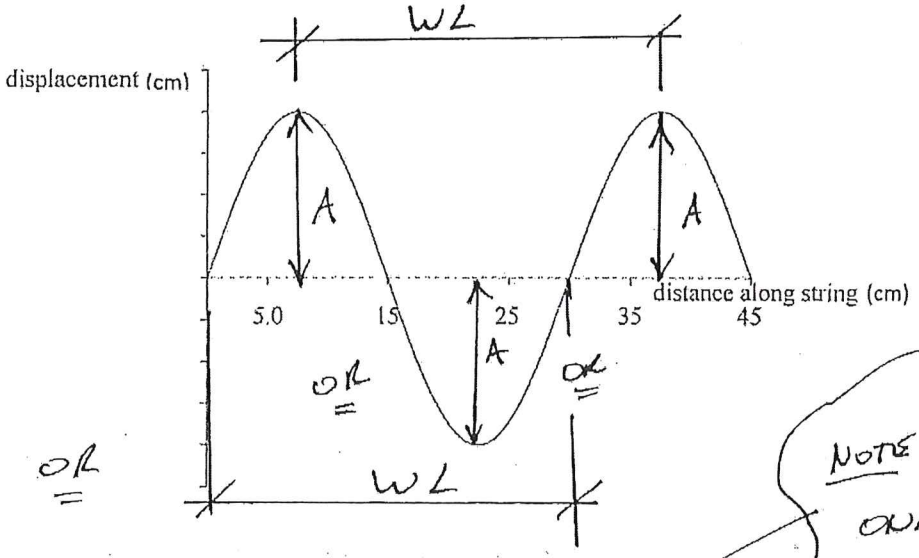
$= -0.125\,ms^{-1}$ (1)

OR $1.25 \times 10^{-1}\,ms^{-1}$ W

#MINUS (1/2) IF NO DIRECTION IN ANSWER.

Question 13 **(5 marks)**

The diagram below shows a transverse wave travelling along a string that is under tension.



On the diagram above, show:

- the amplitude of the wave. Label this A. (1)
- The wavelength of the wave. Label this WL. (1)

NOTE: MINUS (1) MARK ONLY IF T WAS NOT IDENTIFIED IN MILLISECONDS. (ms)

Given that the period of the wave is 1.20 ms, find the velocity of the wave.

For (f)

$f = \dfrac{1}{T}$ (1)

$= \dfrac{1}{1.20 \times 10^{-3}} = 833.33\,Hz$ 10

Now For (V)

$V = f\lambda$

$= 833.333 \times (0.3)$ (1)

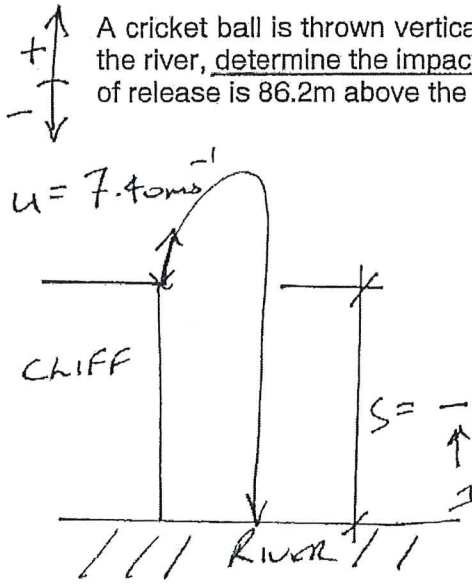
$= 250\,ms^{-1} \pm 10\,ms^{-1}$

(1)

ACCEPT $[0.29 - 0.31\,m]$

Question 14 **(3 marks)**

A cricket ball is thrown vertically upward from a cliff at 7.40ms^{-1}. Given that the cliff is 86.2m above the river, determine the impact velocity of the ball as it enters the water below. Assume that the point of release is 86.2m above the river and that the ball doesn't experience any air resistance.



$v^2 = u^2 + 2as$ (1)

!!!

$\therefore v = \sqrt{(7.4)^2 + 2(-9.8)(-86.2)}$ (1)

$= \sqrt{54.76 + 1689.52}$

$= \sqrt{1744.28}$

$\therefore v = 41.76$

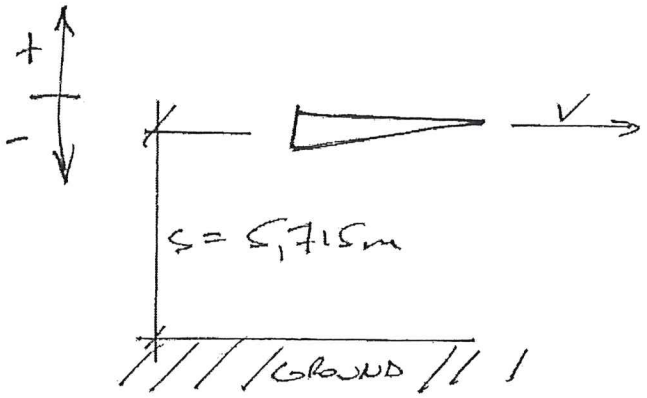
$= 41.8 ms^{-1}$

OR $= -41.8 ms^{-1}$ (1)

*IF 'g' OR 's' IS NOT NEG (−) THEN MINUS (1) MARK ONLY.

Question 15 **(3 marks)**

A fighter aircraft is travelling horizontally at a constant velocity of 890 kmh^{-1} at an altitude of 5,715m. If a bomb of mass 862kg is released at an altitude of 5,715m above the ground, determine the time it would take for the bomb to hit the ground. Ignore air resistance.



FOR TIME TO FALL

$s = ut + \frac{1}{2}at^2$ (1)

$\therefore s = \frac{1}{2}at^2$

$t^2 = \frac{2s}{a}$

$\therefore t = \sqrt{\frac{2s}{a}}$

$= \sqrt{\frac{2 \times (-5,715)}{-9.8}}$ (1)

$= \sqrt{1166.326}$

$= 34.15$

$= 34.2$ s (1)

KEY POINT – WE ONLY CONSIDER THE VERTICAL COMPONENT OF MOTION!

/6

End of Section One