



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

EXEMPLAR 2008

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, a 3-page data sheet, an answer sheet and graph paper.

INSTRUCTIONS AND INFORMATION

1. Write your name and/or examination number (and centre number if applicable) in the appropriate spaces on the ANSWER SHEET, ANSWER BOOK and GRAPH PAPER.
2. Answer ALL the questions.
3. Answer SECTION A on the attached ANSWER SHEET.
4. Answer SECTION B in the ANSWER BOOK. Answer QUESTION 10.1 on the attached GRAPH PAPER.
5. Non-programmable calculators may be used.
6. Appropriate mathematical instruments may be used.
7. Number the answers correctly according to the numbering system used in this question paper.
8. Data sheets are attached for your use.
9. Give brief motivations, discussions, et cetera where required.

SECTION A

Answer this section on the attached ANSWER SHEET.

QUESTION 1: ONE-WORD ITEMS

Give ONE word/term for EACH of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) on the attached ANSWER SHEET.

- 1.1 Change in momentum (1)
- 1.2 Energy that an object has because of its motion (1)
- 1.3 The ability of a wave to spread out after it has passed through a small aperture (1)
- 1.4 The electric potential energy of a point charge situated at a point divided by the charge itself (1)
- 1.5 The minimum energy needed to eject electrons from a metal using light (1)
- [5]**

QUESTION 2: MATCHING ITEMS

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A – J) next to the question number (2.1 – 2.5) on the attached ANSWER SHEET.

COLUMN A		COLUMN B	
2.1	The energy that an object has due to its height above a reference point	A	radio waves
		B	primary colours
2.2	Any two colours which, when added together, give white light	C	photo-electric effect
		D	kinetic energy
2.3	The force per unit charge	E	sound waves
2.4	Waves propagated as magnetic and electric fields that oscillate perpendicularly to each other	F	gravitational potential energy
		G	thermionic effect
2.5	The emission of electrons from a metal surface using light of an appropriate frequency	H	potential difference
		I	complementary colours
		J	electric field

[5]

QUESTION 3: TRUE/FALSE ITEMS

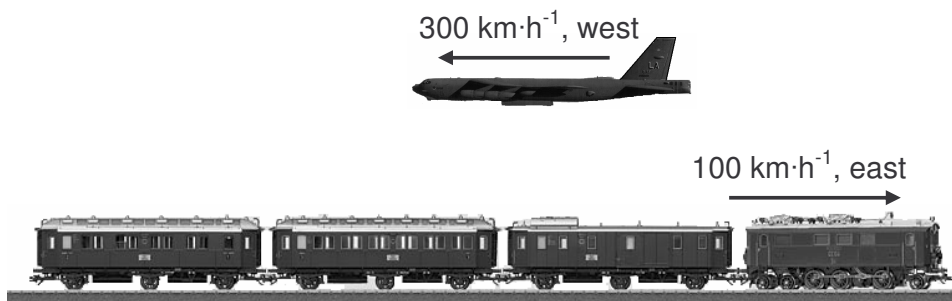
Indicate whether the following statements are TRUE or FALSE. Choose the answer and write 'true' or 'false' next to the question number (3.1 – 3.5) on the attached ANSWER SHEET. Correct the statement if it is FALSE.

- 3.1 No work is done by the earth's gravitational force on a satellite which is moving at a constant speed and constant altitude around the earth. (2)
- 3.2 When catching a ball, a cricketer pulls his hands back to reduce the change in momentum of the ball. (2)
- 3.3 When monochromatic light passes through glass its frequency changes. (2)
- 3.4 A filament bulb is an ohmic conductor because it emits heat energy. (2)
- 3.5 The photo-electric effect is proof that light has a wave nature. (2)
- [10]**

QUESTION 4: MULTIPLE-CHOICE QUESTIONS

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer and make a cross (X) in the block (A – D) next to the question number (4.1 – 4.5) on the attached ANSWER SHEET.

- 4.1 A girl sits in a train travelling east at $100 \text{ km}\cdot\text{h}^{-1}$. An aeroplane, travelling west at $300 \text{ km}\cdot\text{h}^{-1}$, passes overhead.



Which ONE of the following is the description of how the aeroplane is moving relative to the girl in the train?

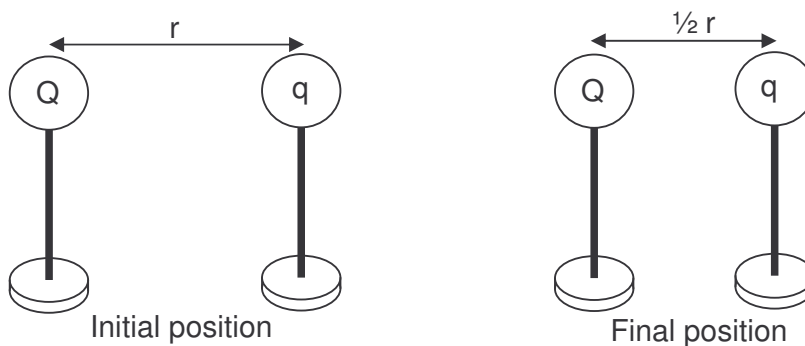
	Magnitude of velocity of aeroplane ($\text{km}\cdot\text{h}^{-1}$)	Direction of velocity of aeroplane
A	400	west
B	200	east
C	200	west
D	400	east

(3)

- 4.2 An object moving at a constant velocity v has a kinetic energy E . The velocity is changed to $2v$. Which ONE of the following is the correct kinetic energy at this velocity?
- A $\frac{1}{4}E$
- B $\frac{1}{2}E$
- C $2E$
- D $4E$ (3)

- 4.3 Cut glass is used to make ornaments. In light, it shows all the colours of the rainbow. Which ONE of the following is NOT an explanation for this observation?
- A White light consists of a spectrum of colours.
- B Each colour in white light is refracted by different amounts in glass.
- C Cut glass has its own characteristic colours.
- D White light splits into colours of different frequencies as it passes through glass. (3)

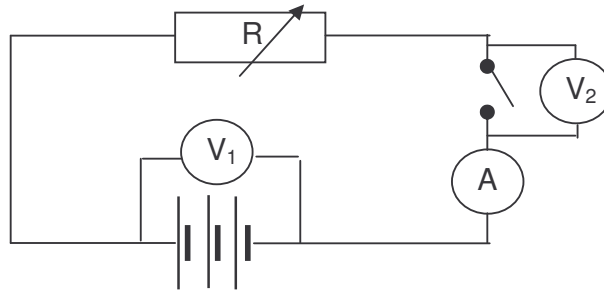
- 4.4 Two identical metal spheres on insulated stands carry charges of Q and q respectively, as indicated in the diagram. When they are at a distance r from each other, they experience a force F .



The two charges are now moved closer to each other so that the final distance between them is half the original distance, as illustrated. Which ONE of the following correctly describes the new magnitude of the force that the charges experience?

- A $\frac{1}{4}F$
- B $\frac{1}{2}F$
- C $2F$
- D $4F$ (3)

- 4.5 A variable resistor, an ammeter, a battery of emf 12 V and voltmeters V_1 and V_2 are connected as shown in the diagram below.



When the switch is open, the readings on voltmeters V_1 and V_2 respectively are ...

	Reading on V_1	Reading on V_2
A	12 V	0 V
B	12 V	12 V
C	0 V	0 V
D	0 V	12 V

(3)
[15]

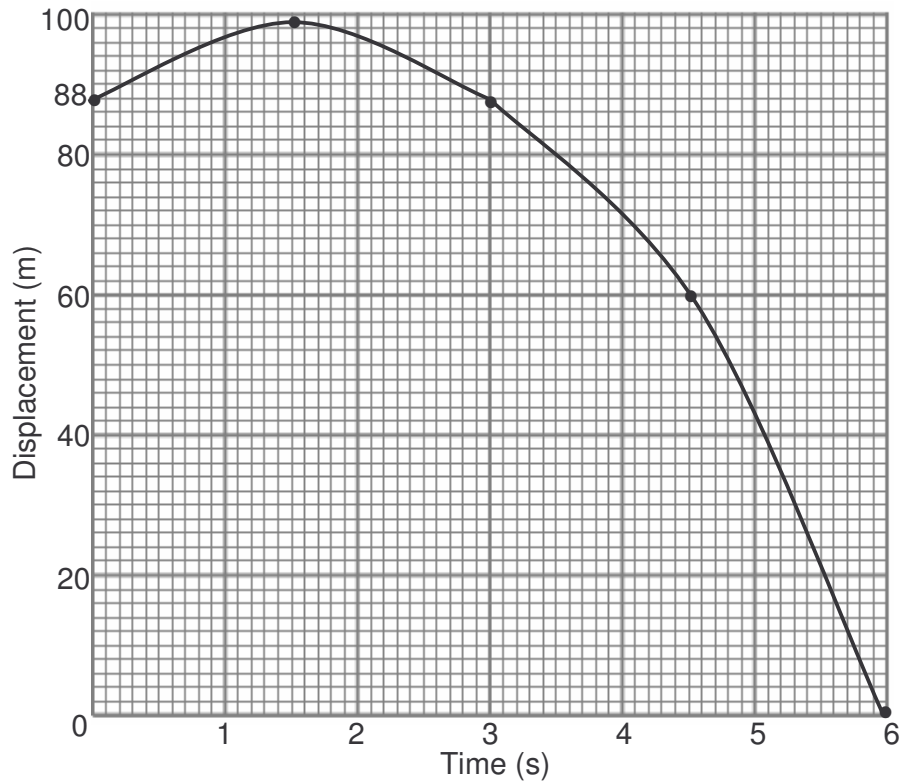
TOTAL SECTION A: 35

SECTION B**INSTRUCTIONS AND INFORMATION**

1. Answer SECTION B in the ANSWER BOOK.
2. The formulae and substitutions must be shown in ALL calculations.
3. Round off your answers to TWO decimal places.

QUESTION 5

A hot-air balloon is rising vertically at constant velocity. When the balloon is at a height of 88 m above the ground, a stone is released from it. The displacement-time graph below represents the motion of the stone from the moment it is released from the balloon until it strikes the ground. Ignore the effect of air resistance.



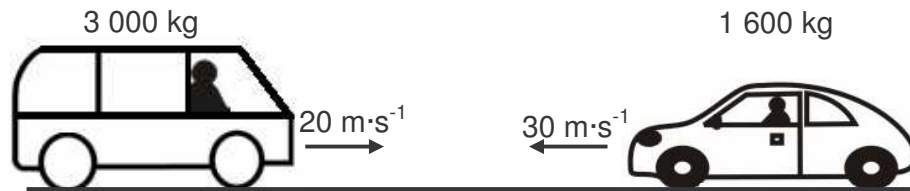
Use information from the graph to answer the following questions:

- 5.1 Calculate the velocity of the hot-air balloon at the instant the stone is released. (6)
- 5.2 Draw a sketch graph of velocity versus time for the motion of the stone from the moment it is released from the balloon until it strikes the ground. Indicate the respective values of the intercepts on your velocity-time graph. (3)

[9]

QUESTION 6

Collisions happen on the roads in our country daily. In one of these collisions, a car of mass 1 600 kg, travelling at a speed of $30 \text{ m}\cdot\text{s}^{-1}$ to the left, collides head-on with a minibus of mass 3 000 kg, travelling at $20 \text{ m}\cdot\text{s}^{-1}$ to the right. The two vehicles move together as a unit in a straight line after the collision.



- 6.1 Calculate the velocity of the two vehicles after the collision. (6)
- 6.2 Do the necessary calculations to show that the collision was inelastic. (6)
- 6.3 The billboard below advertises a car from a certain manufacturer.

Safety first!
Both in one package!

Airbag

Crumple zone

Before impact

After impact

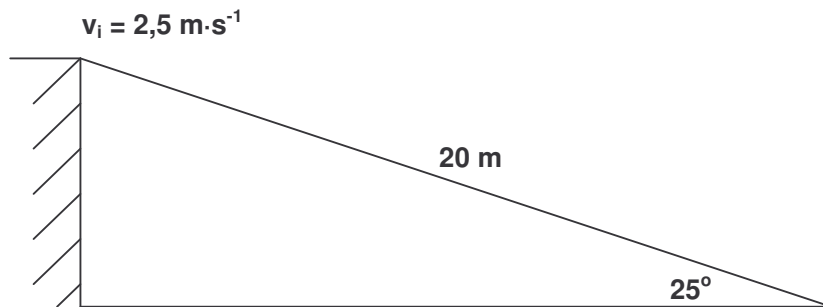
Use your knowledge of momentum and impulse to justify how the safety features mentioned in the advertisement contribute to the safety of passengers.

(3)
[15]

QUESTION 7

A person skis down a 20 m long snow slope which makes an angle of 25° with the horizontal.

The total mass of the skier and skis is 50 kg. There is a constant frictional force of 60 N opposing the skier's motion. The speed of the skier as he/she descends from the top of the slope is $2,5 \text{ m}\cdot\text{s}^{-1}$.



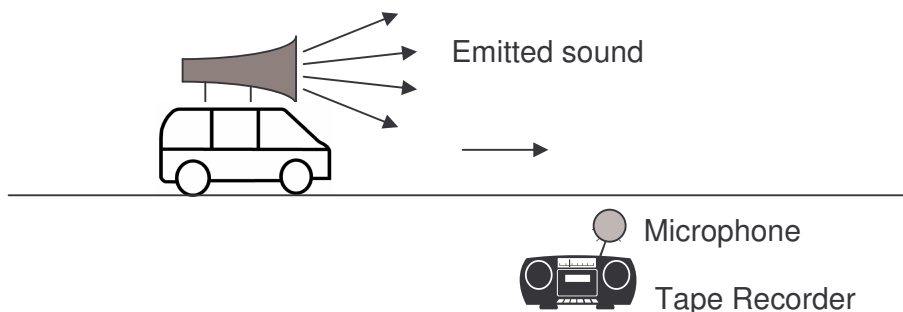
7.1 Calculate the magnitude of the net force parallel to the slope experienced by the person. (5)

7.2 Calculate the maximum speed of the skier at the bottom of the 20 m slope. (6)

[11]

QUESTION 8

During an experiment to determine the speed of sound, learners are given a siren that sounds a single note of frequency 426 Hz. They attach it to a remote controlled car and move it at constant speed past a stationary tape recorder which is mounted in the middle of a runway. Ignore the effects of friction. The tape recorder records the sound of the siren.



The learners make the following observation:

The pitch of the sound from the siren as it moved towards the tape recorder was higher than the pitch as the siren moved away from the recorder.

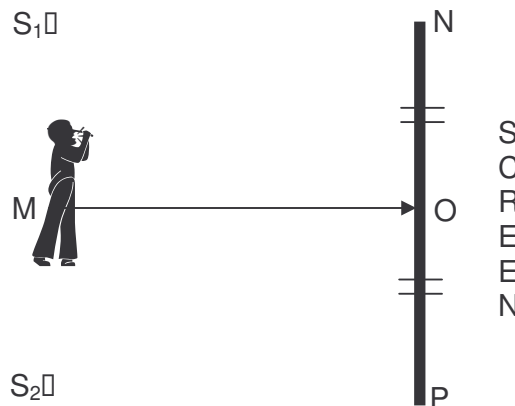
8.1 Name the effect which explains this observation. (2)

In one of the trials the speed of the remote controlled car was noted as $31 \text{ km}\cdot\text{h}^{-1}$. Two notes from the siren were recorded: one with a frequency of 437 Hz and the other note with a frequency lower than 426 Hz .

- 8.2 Convert $31 \text{ km}\cdot\text{h}^{-1}$ to $\text{m}\cdot\text{s}^{-1}$. (2)
- 8.3 Determine the speed of sound in air. (5)
- 8.4 Give a reason why the observed frequencies are respectively higher and lower than the frequency of the source (426 Hz). (2)
- [11]**

QUESTION 9

Red light from two stationary narrow slits, S_1 and S_2 , reaches a large white screen PON, indicated in the diagram below.



A dark band is observed at point P on the screen. The brightest band is observed at point O on the screen. Bands are arranged such that the band at point N on the screen is dark.

- 9.1 State Huygens' principle in words. (2)
- 9.2 Write down the type of interference that occurs at point O. Write down only DESTRUCTIVE or CONSTRUCTIVE. Briefly explain your answer. (3)
- 9.3 Describe the change in brightness, if any, of the light bands formed on the screen as you walk closer to the screen from point M to point O. Briefly explain your answer. (3)

The red light is now replaced with a green light.

- 9.4 How will the new pattern differ from the previous one? (2)
- [10]**

QUESTION 10

A learner sets up a circuit as illustrated in the circuit diagram below to investigate the change in electric current over time while a capacitor is being charged. Initially there is no charge on the capacitor.

After closing the switch, the learner takes the ammeter readings every 20 seconds. The table below shows the results obtained during the investigation.

I (

ERROR: rangecheck
OFFENDING COMMAND: .buildcmap

STACK:

-dictionary-
/WinCharSetFFFF-VTT6C246407t
/CMap
-dictionary-
/WinCharSetFFFF-VTT6C246407t