Aligned to DBE Revised ATPs

Platinum

Physical Sciences

Navigation pack

FET PHASE
GRADE 10

Platinum

Physical Sciences

Pearson

FET PHASE
GRADE 10

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Dear Teacher

The National State of Disaster due to the COVID-19 pandemic has resulted in the disruption of Education in South Africa and the loss of valuable teaching time and disruption of the school calendar.

As a result of this, the DBE has created and released revised Annual Teaching Plans (ATPs) to assist schools and teachers in ensuring the 2021 school year is completed. The 2021 ATPs are based on the revised ATPs that were developed in 2020. It is important to note that fundamental and core topics are retained in the 2021 ATPs. Some of the strategies that have been used in the process of developing the 2021 DBE ATPs are:

- reduction of content covered in certain topics
- merging of topics
- deleting topics
- revising the assessment guidelines
- reduction in teaching time for certain topics
- resequencing of topics/concepts

At Pearson South Africa, we believe that education is the key to every individuals' success. To ensure that despite the challenges, teachers and learners can meet all the necessary learning outcomes for the year, we have created the Navigation Guide, a free resource to support teachers and learners during this challenging time.

The Navigation Pack aims to summarise and highlight the changes in the 2021 DBE ATP and provide teachers and learners with worksheets that focus on impacted topics in the curriculum.

Due to resequencing of topics, the order of topics in the textbook that is currently used in the classroom may not be aligned to the new sequence of topics in the ATP. Pearson has included page numbers from one of our tried and tested series, Platinum, to guide the teacher and learners as they navigate through the textbook, with the 2021 ATP. The Navigation Pack has a set of assessments based on the Section 4 changes and the revised assessment guidelines.

COVID-19 safety guidelines for teachers and learners

Gatherings at school

Where schools are open for learning, it is up to management to take decisive action to ensure sites are not simultaneously used for other functions such as shelters or treatment units in order to reduce the risk.

Implement social distancing practices that may include:

- A staggered timetable, where teachers and learners do not arrive/leave at the same time for the beginning and end of the school day.
- Cancelling any community meetings/events such as assemblies, cake sales, market days, tuckshop, after-care classes, matric dance, Eisteddfod and other events.
- Cancelling any extra-mural activities such as ballet classes, swimming lessons, sport games, music class and other events that create a crowd gathering.
- Teaching and modelling creating space and avoiding unnecessary touching.
- Limiting movement and interaction between classes.
- Schools with an established feeding scheme plan are to ensure that hygiene and social distancing is always implemented. Teachers and staff members assisting with food distribution are to wear masks, sanitise prior to issuing food items and learners are to stand 1,5m apart in the queue.

Wear a mask at all times.

1. Restrooms/toilets

Hand washing

Washing hands with soap and water or using alcohol-based hand sanitisers is one of the most important ways to help everybody stay healthy at school. Critical to this is preparing and maintaining handwashing stations with soap and water at the toilet and in each classroom.

Teachers and learners should always wash their hands after:

- eating
- entering the classroom
- using the toilet
- blowing your nose or coughing
- touching tears, mucous, saliva, blood or sweat.

2. Premises and classroom setting

When schools open, classroom settings should be altered in order to promote hygiene, safety and social distancing.

Changed classroom settings may include:

- Cleaning and disinfecting school buildings, classrooms and especially sanitation of facilities at least once a day, particularly surfaces that are touched by many people (railings, lunch tables, sports equipment, door and window handles, toys, teaching and learning tools, etc.).
- Ensuring the proper ventilation and fresh flow of air through classrooms.
- Providing learners with vital information about how to protect themselves by incorporating the importance of hygiene, handwashing and other measures of protecting themselves, into the lessons.
- Promoting best handwashing and hygiene practices and providing hygiene supplies.

- Prepare and maintain handwashing stations with soap and water, and if possible, place alcohol-based hand sanitisers in each classroom, at entrances and exits, and near lunchrooms and toilets.

- Ensure teachers and learners wear a mask at all times.

Social distancing

- Space the learners out in the classroom (or outdoors) – try to keep learners separated by a minimum of 1,5m

- Create space for learner's desks to be at least 1,5m apart
- Learners should not share cups, eating utensils, or food
- Do not let learners eat items that fall on the floor or chew on pencils or other objects
- Learners are not to exceed 30 per class or 50% of original class size

- Avoid close contact, like shaking hands, hugging or kissing

3. Social behaviour

It is extremely vital during a pandemic that focus is not only directed towards optimal physical health and hygiene but finding ways to facilitate mental health support.

- Treat everybody with respect and empathy – no teasing about COVID-19.
- Encourage kindness towards each other and avoid any stereotyping when talking about the virus.
- Stay home if you have a temperature or are ill.
- Do not touch people who are ill, but be empathetic.

Wear a mask at all times.

How to Use this Navigation Pack

Revised DBE Teaching Plan: Comprehensive summary of the CAPS topics according to the revised ATPs.

Navigation Plan: Links to additional resources in the Pearson Navigation Pack.

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
Themes	**Topic**	**Unit**	**Time**	**Links to Pearson Navigation Pack**	**Page reference**
WAVES, SOUND AND LIGHT	Electromagnetic radiation [9 hrs] *10	The nature of electromagnetic radiation	2 hrs		
		The electromagnetic spectrum	3 hrs		
		The electromagnetic radiation as particle – Photon	4 hrs	Navigation Pack: Targeted Worksheet 1	Page 15
	Consolidation and revision [16 hrs]		16 hrs		
HYDROSPHERE *11					
ASSESSMENT		End of year exam		Navigation Pack: Paper 1 Physics	Page 45
		End of year exam		Navigation Pack: Paper 2 Chemistry	Page 56
TOTAL HOURS = 25					

*10 This topic has been moved from term 1 to term 4. This topic is on pages 84–90 in the Platinum LB, and pages 46–48 in the Platinum teacher's guide book.

*11 The whole topic has been removed.

Assessments for the Term as per the revised ATPs and the Section 4 amendments.

Link to a targeted worksheet in the Navigation Pack, that focus on impacted or challenging topics in the curriculum.

Footnotes provide any additional information.

Link to an exemplar assessment in the Navigation Pack, that was created with Section 4 and curriculum changes in mind.

Navigation Guide

FET PHASE

Physical Sciences

GRADE	NO OF WEEKS	CONTENT, CONCEPTS & SKILLS (WEEKS)	FORMAL ASSESSMENT (WEEKS)
10	40	36	4
11	40	36	4
12	40	29	11

*4 hours teaching time per week, with 40 weeks per grade, means the total teaching time per year is 160 hours

THEME	GRADE 10	GRADE 11	GRADE 12
PHYSICS: MECHANICS	Introduction to vectors and scalars, Motion in one dimension, Energy [32 hours]	Vectors in two dimensions, Newton's Law and Application of Newton's Laws [26 hours]	Momentum and Impulse, Vertical projectile motion in one dimension, Work, Energy and Power [25 hours]
PHYSICS: WAVES, SOUND & LIGHT	Transverse pulses on a string or spring, Transverse waves, Longitudinal waves, Sound, Electromagnetic radiation [17 hours]		Doppler Effect [6 hours]
PHYSICS: ELECTRICITY & MAGNETISM	Magnetism, Electrostatics, Electric circuits [14 hours]	Electrostatics, Electromagnetism, Electric circuits [26 hours]	Electric circuits, Electrodynamics [13 hours]
CHEMISTRY: MATTER & MATERIALS	Revise matter and classification, States of matter and the kinetic molecular theory, Atomic structure, Periodic table, Chemical bonding [24 hours]	Atomic combinations, Intermolecular forces, Ideal gases [21 hours]	Optical phenomena and properties of materials**, Organic chemistry, Organic macromolecules [19 hours]
CHEMISTRY: CHEMICAL CHANGE	Physical and chemical change, Representing chemical change, Reactions in aqueous solutions, Quantitave aspects of chemical change,Stoichiometry [15 hours]	Stoichiometry, Energy and chemical change, Types of reactions [29 hours]	Reaction rate, Chemical Equilibrium, Acids and bases, Electrochemical reactions [27 hours]

**physics content

Term 2

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
THEMES	**TOPICS**	**UNITS**	**TIME**	**LINKS TO PLATINUM SERIES AND PEARSON NAVIGATION GUIDE**	**PAGE REFERENCE**
ELECTRICITY & MAGNETISM	Electric circuits [1] [5 hrs]	Resistance	1 hr	• Plat LB • Plat TG	• Page 147–158 • Page 80–86
		Resistors in Series	2 hrs		
		Resistors in parallel	2 hrs		
MECHANICS [2]	Vectors and scalars [4 hrs]	Physical quantities, Introduction to vectors and scalars	2 hrs	• Plat LB • Plat TG	• Page 202–209 • Page 109–112
		Resultant vectors	2 hrs		
	Motion in one dimension [8 hrs]	Reference frame and position	2 hrs	• Plat LB • Plat TG	• Page 210–222 • Page 113–119
		Distance and displacement	2 hrs		
		Average speed and velocity	2 hrs		
		Acceleration	2 hrs		
	Instantaneous speed and velocity [8 hrs]	Instantaneous velocity and instantaneous speed	2 hrs	• Plat LB • Plat TG • Navigation Guide: Targeted Worksheet 1	• Page 223–236 • Page 120–134 • Page 17
		Describing motion of an object	2 hrs		
		Graphs of velocity versus time	2 hrs		
		Graphs of acceleration versus time	2 hrs		
	Equations of motion [4 hrs]	Use the equations of motion, listed below, to solve problems involving motion in one dimension in the horizontal plane only. $v_f = v_i + a\,\Delta t$ $\Delta x = v_1 \Delta t + \frac{1}{2}\,a\,\Delta t^2$ $v_f^2 = v_i^2 + 2a\,\Delta x$ $\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$ (Solve problems for the motion of a vehicle including safety issues such as the relationship between speed and stopping distance)	4 hrs	• Plat LB • Plat TG • Navigation Guide: Targeted Worksheet 2	• Page 237–241 • Page 135–138 • Page 19

1 The topic has been moved to term 1 and 2. Term 1 covers emf, potential difference and strength of current. In term 2, resistance, arrangement of resistors and calculating effective resistance in a circuit are covered. These subtopics are on pages 147–158 in the Platinum Learner's Book, and pages 80–86 in the Platinum Teacher's guide Book.

2 This topic has been moved from term 3 to term 2.

Term 2

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
THEMES	**TOPICS**	**UNITS**	**TIME**	**LINKS TO PLATINUM SERIES AND PEARSON NAVIGATION GUIDE**	**PAGE REFERENCE**
	Energy [8 hrs]	Gravitational potential energy of an object. $E_p = mgh$ OR $U = mgh$	2 hrs	• Plat LB • Plat TG	• Page 242–247 • Page 139
		Kinetic energy of an object $E_k = \frac{1}{2} mv^2$ OR $K = \frac{1}{2} mv^2$.	2 hrs		
		Mechanical energy $E_m = E_k + E_p$ OR $E_m = K + U$	4 hrs		
ELECTRICITY & MAGENTISM	Magnetism[3]				
MATTER & MATERIALS	Particles substances are made of [4]				
ASSESSMENTS		Control test		• Navigation Pack: Term 2 Control test	
TOTAL HOURS = 37					

3 The whole topic has been removed from the curriculum. This topic is on page 129–133 in the Platinum Learner's Book and page 71–73 in the Platinum Teacher's Guide.

4 The whole topic has been removed from the curriculum. This topic is on page 95–102 of the Platinum Learner's Book and page 52–54 in the Platinum Teacher's Guide.

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
THEMES	TOPICS	UNITS	TIME	LINKS TO PLATINUM SERIES AND PEARSON NAVIGATION GUIDE	PAGE REFERENCE
CHEMICAL CHANGE	Physical and chemical change[5] [2 hrs]	Physical change and examples	1 hr	• Plat LB • Plat TG	• Page 106–113 • Page 57–60
		Chemical change and examples	1 hr		
	Representing chemical change [6] [6 hrs]	Word equations from chemical equations and vice versa	1 hr	• Plat LB • Plat TG • Navigation Guide: Targeted Worksheet 3	• Page 114–126 • Page 60–68 • Page 21
		Balancing chemical equations	1 hr		
		Conservation of atoms and mass	2 hrs		
		Law of constant composition	2 hrs		
	Quantitative aspects of chemical change [11 hrs]	Atomic mass and mole concept	1 hr	• Plat LB • Plat TG	• Page 181–197 • Page 100–106
		Molecular mass and formula mass	1 hr		
		Molar mass and its relationship to molecular mass and formula mass	1 hr		
		Determine composition of substances	2 hrs		
		Amount of substance [mole], molar volume of gases, concentration of solutions	2 hrs		
		Basic stoichiometric calculations	4 hrs		
	Reactions in aqueous solution [7]				

5 This topic has been moved from term 2 to term 3.

6 This topic has been moved from term 2 to term 3.

7 The whole topic has been removed. The topic is on pages 163–180 in the Platinum Learner's Book, and pages 92–99 in the Teacher's guide Platinum Book.

Term 3

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
THEMES	**TOPICS**	**UNITS**	**TIME**	**LINKS TO PLATINUM SERIES AND PEARSON NAVIGATION GUIDE**	**PAGE REFERENCE**
WAVES, SOUND AND LIGHT [8]	Transverse pulses on a string/spring [2 hrs]	Pulses	1 hr	• Plat LB • Plat TG	• Page 58–63 • Page 31–35
		Superposition of pulses	1 hr		
	Transverse waves [4 hrs]	Wave properties	1 hr	• Plat LB • Plat TG	• Page 64–67 • Page 36–37
		Period and frequency	2 hrs		
		Wave speed	1 hr		
	Longitudinal waves [4 hrs]	Longitudinal waves	1 hr	• Plat LB • Plat TG	• Page 68–73 • Page 38–40
		Amplitude, wavelength, frequency, period and wave speed	2 hrs		
		Calculations involving longitudinal waves	1 hr		
	Sound [6 hrs]	Sound waves	2 hrs	• Plat LB • Plat TG	• Page 74–83 • Page 40–45
		Pitch, loudness and quality of sound	2 hrs		
		Ultrasound	1 hr		
		Wave equation ($v = f\lambda$) to solve problems involving sound waves including echoes, e.g. sonar, bats and dolphins.	1 hr		
ASSESSMENTS		Control test		• Navigation Pack: Term 3 Control test	Page 31
TOTAL HOURS = 35					

8 The three subtopics have been moved from term 1 to term 3 except Electromagnetic radiation which has been moved to term 4. Term 3 work is on pages 58–83 in the Platinum Learner's book and pages 31–45 in the Teacher's Guide.

Term 4

REVISED DBE ANNUAL TEACHING PLAN				NAVIGATION PLAN	
THEMES	TOPICS	UNITS	TIME	LINKS TO PLATINUM SERIES AND PEARSON NAVIGATION GUIDE	PAGE REFERENCE
WAVES, SOUND AND LIGHT	Electromagnetic radiation [9 hrs] [9]	The nature of electromagnetic radiation	2 hrs	• Plat LB • Plat TG	• Page 84–90 • Page 46–48
		The electromagnetic spectrum	3 hrs		
		The electromagnetic radiation as particle – Photon	4 hrs		
ALL TOPICS	Consolidation and revision [16 hrs]		16 hrs		
HYDROSPHERE [10]					
ASSESSMENT		End of year exam		• Navigation Pack: Final Year Examination Paper 1	• Page 37
ASSESSMENT		End of year exam		• Navigation Pack: Final Year Examination Paper 2	• Page 42
TOTAL HOURS = 32					

9 This topic has been moved from term 1 to term 4. This topic is on pages 84–90 in the Platinum Learner's Book, and pages 46–48 in the Platinum Teacher's Guide.

10 The whole topic has been removed.

Targeted Worksheets

Targeted Worksheet 1

Time: 30 minutes

Topic: Instantaneous velocity and instantaneous speed

TARGETED WORKSHEET	TOPIC IN CAPS
1	Instantaneous velocity and instantaneous speed
2	Equations of motion
3	Representing chemical change

Content summary

Explain the relationship between instantaneous velocity and instantaneous speed. Explain the differences between the two, their units and whether they are vectors or scalar.

Instantaneous speed is the magnitude of the instantaneous velocity. It has the same value as that of instantaneous velocity but does not have any direction.

If the object possesses uniform velocity, then the instantaneous velocity may be the same as its standard velocity.

Targeted Worksheet 1

Time: 30 minutes

Topic: Instantaneous velocity and instantaneous speed

Name: **Surname:**

Instructions

1. Answer all of the questions.
2. Write your answers on lined paper.
3. Number the questions carefully and follow the instructions.
4. Non-programmable calculators may be used.
5. Round off your answers to TWO decimal places.

1.1 Define instantaneous speed and instantaneous velocity. (4)

1.2 During a race, a car covered the first 24 km in 10 minutes. It then had to stop for 2 minutes to have its tyres changed. The car then did the next 36 km in 12 minutes.

a) During what time interval did the car have the highest velocity, and what was its velocity in $m \cdot s^{-1}$ during this time? (5)

b) What was the car's average velocity for the whole race? (3)

2. A cyclist cycles up and down a hill in a minute and covers 360 m in the process.

2.1 Calculate his average speed. (3)

2.2 Why is his instantaneous velocity at any one time most likely to be different to his average velocity? (2)

2.3 What is the difference between instantaneous velocity and instantaneous speed? (2)

Total: [19]

Targeted Worksheet 2

Time: 30 minutes

Topic: Equations of motion

TARGETED WORKSHEET	TOPIC IN CAPS
1	Instantaneous velocity and instantaneous speed
2	Equations of motion
3	Representing chemical change

Content summary

Equations of motion relate the displacement of an object with its velocity, acceleration and time. The motion of an object can follow many different paths. Here the focus is on motion in a straight line (one dimension).

Explain the set of four equations that can be utilised to predict unknown information about an object's motion if other information is known. Each of the equations of motion include four variables. If the values of three of the four variables are known, then the value of the fourth variable can be calculated.

Do more examples with the learners to show them how the equations can be used. Involve questions which need use of more than one equation.

Targeted Worksheet 2

Time: 30 minutes

Topic 2: Equations of motion

Name: **Surname:**

Instructions

1. Answer all of the questions.
2. Write your answers on lined paper.
3. Number the questions carefully and follow the instructions.
4. Non-programmable calculators may be used.
5. Round off your answers to TWO decimal places.

1. An object that is moving with a velocity of +2 $m \cdot s^{-1}$ accelerates for 5 seconds with an acceleration of +0,6$m \cdot s^{-2}$.
   1.1 Calculate its final velocity using equations of motion. (3)
   The object then slows to a stop, covering 10 m while it is slowing.
   1.2 Calculate its acceleration using equations of motion. (3)
2. A bullet is fired at 970 $m \cdot s^{-1}$ in an easterly direction. It reaches a target 200 m away, only 0,23 seconds later. Calculate:
   2.1 the magnitude and direction of the acceleration of the bullet (3)
   2.2 the magnitude of the velocity with which the bullet strikes the target. (3)
3. A very tired Thandeka is on her way to see her parents and she is driving at 80 $km \cdot h^{-1}$. Unfortunately, a truck a few metres ahead of her rams into the back of another car and comes to a halt. Her car can only slow down at a maximum rate of 10 $m \cdot s^{-2}$.
   3.1 Ignoring her reaction time, how far behind the truck should Thandeka be travelling in order to be able to stop before going into the back of it? (4)
   3.2 It takes an alert person 1,5 s to react, while a person who is tired, drunk or distracted takes twice that time. Given that Thandeka was tired, what distance should she have allowed between herself and the truck? (4)

Total: [20]

Targeted Worksheet 3

Time: 30 minutes

Topic: Representing chemical change

TARGETED WORKSHEET	TOPIC IN CAPS
1	Instantaneous velocity and instantaneous speed
2	Equations of motion
3	Representing chemical change

Content summary

In this topic, learners struggle a lot with writing chemical equations and balancing them. In a chemical equation, reactants are written on the left hand side of the equation and the products on the right. When representing chemical change, it is important to be able to write the chemical formula of a compound. This targeted worksheet aims to develop the learners' skill of balancing chemical equations, using a variety of methods including visual representation and tables. Keep practicing until learners can balance chemical equations by inspection. It is therefore essential that more worksheets on writing chemical formulae and balancing of chemical equations are given to learners to practice.

Targeted Worksheet 3

Time: 30 minutes

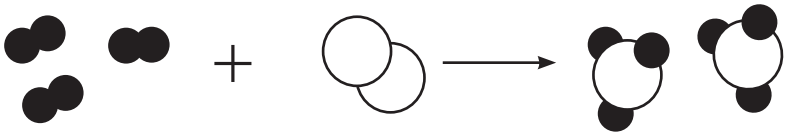
Topic: Representing chemical change

Name: **Surname:**

Instructions

1. Answer all of the questions.
2. Write your answers on lined paper.
3. Number the questions carefully and follow the instructions.
4. Non-programmable calculators may be used.
5. Round off your answers to TWO decimal places.

1. The diagram below represents a chemical reaction.



Key Hydrogen: ●

Nitrogen: ○

Use chemical formulae to write the balanced equation for this reaction. (3)

2. Write out and balance the following equations:

2.1 $H_2S + SO_2 \rightarrow S + H_2O$ (3)

2.2 $CH_3NH_2 + O_2 \rightarrow CO_2 + H_2O + N_2$ (3)

2.3 $C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$ (3)

3. Using chemical formulae, write balanced equations for the following chemical reactions. (4)

3.1 Sodium carbonate + hydrochloric acid sodium chloride + carbon dioxide + water

3.2 Sodium hydroxide + sulfuric acid sodium sulfate + water

Total: [16]

Targeted Worksheet 1 Answers

Time: 30 minutes

Topic: Instantaneous velocity and instantaneous speed

1.1 Instantaneous speed is the magnitude ✓ of the instantaneous velocity. ✓ Instantaneous velocity is the displacement (or change in position) ✓ divided by an infinitesimal (small) time interval. ✓ (4)

1.2

a) Instantaneous velocity during the first 10 minutes:

$v = \frac{\Delta x}{\Delta t} = \frac{24\ 000\ \text{m}}{(10 \times 60)\ \text{s}}$ ✓ = 40 m·s^{-1} in the direction of movement ✓

Instantaneous velocity during the last 12 minutes:

$v = \frac{\Delta x}{\Delta t} = \frac{36\ 000\ \text{m}}{(12 \times 60)\ \text{s}}$ s ✓ = 50 m·s^{-1} in the direction of movement ✓

Therefore the car had the greatest instantaneous velocity in the last 12 minutes. ✓ (5)

b) $\frac{\Delta x}{\Delta t} = \frac{60\ 000\ \text{m}}{(24 \times 60)\ \text{s}}$ ✓✓ = 41,67 m·s^{-1} (3)

2.1 $v = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{360}{60}$ ✓

= 6 m·s^{-1} ✓ (3)

2.2 His instantaneous velocity varies as he travels faster and slower/changes direction ✓ Average velocity is calculated as the total distance that he travels divided by the total time it took. ✓ (2)

2.3 Instantaneous velocity is the rate of displacement over a very short time and has direction, ✓ while instantaneous speed is the distance that was covered, divided by the time it took, over a very short time. ✓ (2)

Total: [19]

Targeted Worksheet 2 Answers

Time: 30 minutes

Topic: Equations of motion

1.1 Use the equation $v_f = v_i + a\Delta t$ ✓ = 2 + (0,6)(5) ✓ = 5·m·s^{-1} in the original direction of motion ✓(3)

1.2 Use the equation $v_f^2 = v_i^2 + 2a\Delta x$ ✓

$a = /(\frac{v_i^2 - v_i^2}{2\Delta x}) = \frac{(0 - 5^2)}{2\times 10}$ ✓ = –1,25 m·s^{-1} = 1,25 m·s^{-2} ✓ in the opposite direction of movement ✓ (3)

2.1 $\Delta x = v_i\Delta t + \frac{1}{2}a\,\Delta t$ ✓

$200 = (970)(0{,}23) + \frac{1}{2}a(0{,}23)^2$ ✓

$a = -873{,}35$ m·s^{-2}

∴ a = 873,35 m·s^{-2} west ✓ (3)

2.2 $\Delta x = (\frac{v_f + v_i}{2})\Delta t$

$200 = (\frac{v_f + 970}{2})0{,}23$ ✓

$v_f + 970 = 2(\frac{200}{0{,}23})$ ✓

$v_f = 769{,}13$ m·s^{-1} ✓ (3)

OR

$v_f = v_i + at$ ✓

$v_f = 970 + (-873{,}35)(0{,}23)$ ✓

$= 769{,}13$ m·s^{-1} ✓

3.1 Converting 80 km·h^{-1} to m·s^{-1}

$\frac{80 \times 1\,000 \text{ m}}{3\,600 \text{ s}}$ ✓ = 22,222 m·s^{-1} ✓

$v_f^2 = v_i^2 + 2a\Delta x$ ✓

$v_f^2 - v_i^2 = 2a\Delta x$ ✓

$0^2 - 22{,}22^2 = 2(-10)\Delta x$

∴ Δx= 24,69 m ✓ (4)

3.2 Since Thandeka was tired, the distance she covered in her

reaction time = 22,22 × 3 ✓

= 66,666 m ✓

Total distance = 66,6666 + 24,69 m = 91,37 m ✓

Thandeka should have been 91,37 m away ✓ (4)

Total: [20]

Targeted Worksheet 3 Answers

Time: 30 minutes

Topic: Representing chemical change

1. $3H_2 + N_2 \rightarrow 2\ NH__3$ ✓✓✓ (3)

2.1 $2H_2S + SO_2 \rightarrow 3S + 2H_2O$ ✓✓✓ (3)

2.2 $4CH_3NH_2 + 9O_2 \rightarrow 4CO_2 + 10H_2O + 2N_2$ ✓✓✓ (3)

2.3 $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$ ✓✓✓ (3)

3.1 $Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$ ✓✓ (2)

3.2 $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ ✓✓ (2)

Total: [16]

Exemplar Assessments

Exemplar Assessments

Time: 2 hours

Term 2 Control Test

Name: **Surname:**

Instructions

1. This question paper consists of five questions
2. Answer ALL questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

Question 1

Multiple-choice: Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4). (i.e. 1.5 E)

1.1 The resultant of two forces is 2 N downward. If one of the forces were 7 N upward, the other would be ...

A 5 N downward
B 9 N downward
C 5 N upward
D 9 N upward (2)

1.2 A trolley accelerates with uniform acceleration. Between 0,4 and 0,6 seconds it moves 30 cm. What was the magnitude of its instantaneous velocity at 0,5 s in $m \cdot s^{-1}$?

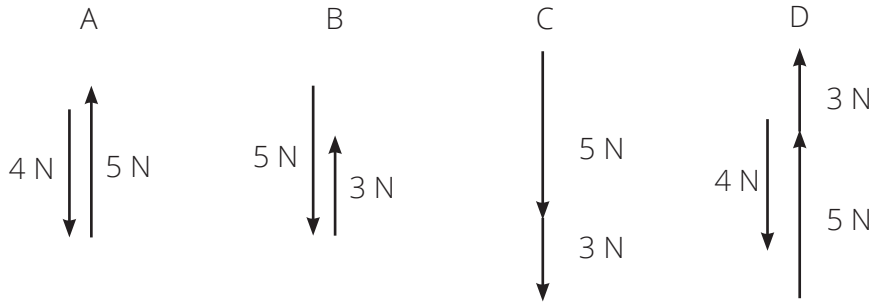
A 150
B 1,5
C 60
D 0,6 (2)

1.3 In rainy weather a car will take longer to stop on a specific road than on a clear day. Which of the following could contribute to that?

(i) The car's acceleration when braking will be less
(ii) The road is more slippery
(iii) The driver's reaction time increases because of poor visibility

A Only (i)
B Only (i) and (ii)
C Only (ii) and (iii)
D (i), (ii) and (iii) (2)

1.4 In which of the following will the vectors have the biggest resultant?



(2)

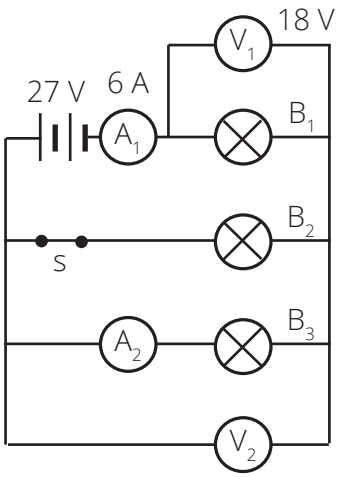
1.5 Which one of the following actions will result in the greatest change in position?

A Sbu runs 2 km, rests for 2 minutes, and runs back 2 km, all in 20 minutes
B Sbu walks a 5 km circular path in 30 minutes
C Sbu runs 4 km on a running machine in a gym
D Sbu runs 3 km in a straight line in 12 minutes (2)

[10]

Question 2

Consider the circuit diagram below. Three identical light bulbs are connected as shown. The terminal potential difference across this circuit is 27 V. The reading on V_1 is 18 V. The current that passes through A_1 is 6 A.



2.1 Calculate the reading on V_2. (2)

2.2 Will the reading on A_2 be MORE THAN, LESS THAN or THE SAME AS the reading on A_1? (1)

2.3 Write down the reason for your answer to question 2.2. (2)

2.4 If the total resistance of the parallel light bulbs is 1,5 Ω, calculate the resistance of one light bulb. (2)

2.5 Calculate the amount of charge that passes through light bulb B_1 in 20 s. (2)

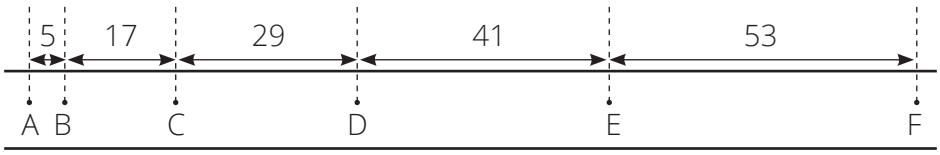
2.6 Switch S is opened. Will the reading on A_2 be MORE THAN, LESS THAN or THE SAME AS the reading on A_1? (1)

2.7 Write down the reason for your answer to question 2.6. (4)

[14]

Question 3

3.1 The ticker tape below was obtained with a trolley accelerating uniformly to the left. The ticker timer had a frequency of 50 Hz. Distances on the diagram are in mm.



3.1.1 Define *acceleration*. (2)

3.1.2 How long did it take from the time the dot at **B** was made until the one at **E** was made? (4)

3.1.3 Calculate the instantaneous velocity of the trolley when dot **E** was made. (3)

3.1.4 The instantaneous velocity of the trolley when dot **B** was recorded was 0,55 $m \cdot s^{-1}$. Calculate the magnitude of the acceleration of the trolley. (3)

3.1.5 Sketch a velocity-time graph of the motion from **A** to **F**, taking left as positive. No specific values have to be shown. (3)

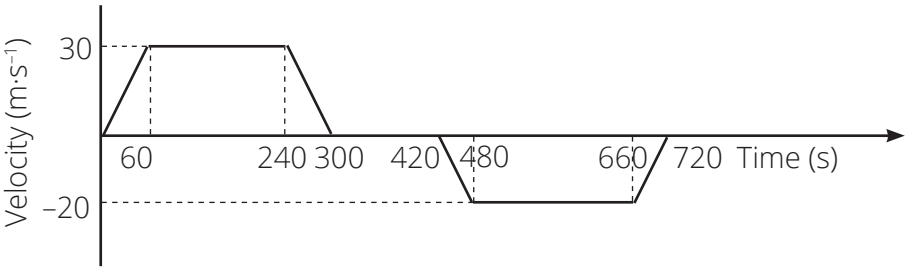
3.2 A Formula 1 car travels at 99 $m \cdot s^{-1}$ down the main straight at Autodrome Hermanos Rodriguez. It has to enter the first turn at a speed of 32 $m \cdot s^{-1}$.

3.2.1 If the car will decelerate at 52 $m \cdot s^{-1}$ when braking, how far before the corner should the driver starts to brake? (3)

The car exits a turn at 30 $m \cdot s^{-1}$ and then reaches 69,5 $m \cdot s^{-1}$ in 6,59 seconds.

3.2.2 Calculate the average acceleration of the car during the 6,59 seconds. (3)

3.3 The following velocity–time graph shows the movement of a train. The train initially moves westwards.



3.3.1 Describe the train's movement during the first 300 seconds. (3)

3.3.2 Calculate the total distance that the train travelled in 720 seconds. (4)

3.3.3 At what time does it reach its furthest point from its starting position? (1)

3.3.4 Calculate the magnitude of the train's average velocity over 720 s. (4)

[33]

Question 4

4.1 The following forces are exerted on a box that stands on the floor:

- its weight of 45 N
- a downward force of 20 N exerted by Amber and
- the force exerted by the floor on the box. The resultant of all these forces is zero.

4.1.1 Define resultant. (2)

4.1.2 Draw a vector diagram to show the forces exerted on the box. Label all the forces clearly. (3)

4.1.3 Use a scale diagram to determine the magnitude of the force exerted by the floor. Use the tail-to-head method and a scale of 1 cm = 10 N. (4)

4.1.4 If Amber stops pushing the box down, the forces on the box will still have a resultant of zero. What will happen to the magnitude of the upward force of the floor on the box? Just write INCREASE, DECREASE or REMAINS UNCHANGED. (1)

4.2 Keasha leaves a shop on her street, 1 200 m south of her home. She walks 3 minutes to another clothing shop 1 400 m south of her home and stays there for 2 minutes. She then walks to her friend Jovani in 10 minutes. Jovani's house is 650 m south of Keasha's home. The two of them then walk 900 m north to Emma's home in 12 minutes. This was all done on the same straight street. Use Keasha's house as the reference point for her position.

4.2.1 Refer to this example and explain what is meant by a frame of reference. (3)

4.2.2 What was Keasha's total displacement from the moment she left the first shop until she and Jovani reached Emma's house? (4)

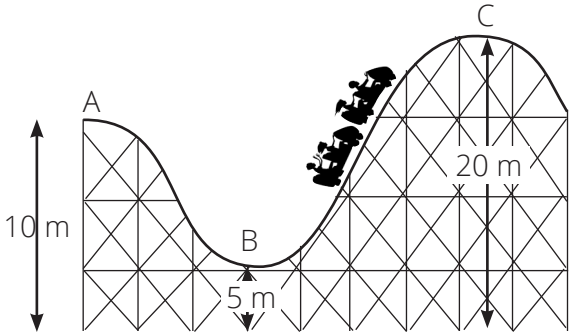
4.2.3 As Keasha and Jovani walk to Emma's house they stop along the way to chat to some people. Explain why their average velocity differs from their instantaneous velocity for this 12 minute walk. (3)

4.2.4 Calculate the magnitude of Keasha's average velocity from the moment she left the first shop, until she and Jovani reached Emma's house. (3)

[23]

Question 5

The diagram shows a roller coaster.



The cart passes point A at a speed of 6 m·s^{-1}. **A** is 10 m high, **B** is 5 m and **C** is 20 m high. Consider the cart as an isolated system. The frictional force of the track can be ignored.

5.1 Define *mechanical energy*. (2)

5.2 Explain what is meant by an *isolated system*. (3)

5.3 How does the mechanical energy of the cart at **A** compare to that at **B**? Explain your answer. (3)

5.4 If the cart and its passengers together have a mass of 600 kg, calculate the total mechanical energy of the cart and passengers. (4)

5.5 Calculate the speed of the cart at point **B**. (4)

5.6 Determine whether the cart has enough energy to reach point **C** without the help of an engine. (4)

[20]

Total: [100]

Exemplar Assessments

Time: 2 hours

Term 3 Control Test

Name: **Surname:**

Instructions

1. This question paper consists of TWO SECTIONS:
   SECTION A: PHYSICS [40 Marks]
   SECTION B: CHEMISTRY [60 Marks]
2. Answer ALL questions in both sections.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

SECTION A: PHYSICS

Question 1

Multiple choice: Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4). (i.e. 1.5 E)

1.1 The symbol and standard unit for the period of a wave is.

A λ, metre
B f, hertz
C T, seconds
D p, seconds (2)

1.2 Which one of the following is NOT true regarding points on a wave which are in phase?

A They always have the same speed.
B They always have the same velocity.
C They are separated by a whole number multiple of complete wavelengths.
D They move in opposite directions. (2)

1.3 In which of the following cases will the mechanical energy of an object increase?

A It is lifted from the floor to a table.

B It swings on a pendulum to its highest point.

C It runs uphill on a frictionless track.

D It slides horizontally on a frictionless track. (2)

1.4 What is the region in space around Earth called where mass will experience Earth's gravitational force?

A Magnetosphere

B Gravitational pull

C Gravitation field

D Magnetic field (2)

1.5 Which one of the following is an example of a longitudinal wave?

A A person waving his hand up and down to say goodbye.

B A Mexican wave made by people watching soccer.

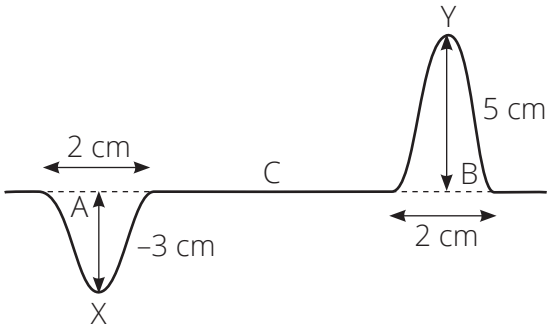
C The blowing wind causing waves in the corn on a corn field.

D Water waves that form in the ocean near the beach (2)

[10]

Question 2

Two pulses, X and Y, approach each other in a spring. Pulse X has an amplitude of –3 cm at position **A** and pulse Y has an amplitude of +5 cm when it is at position **B**. Moments later the two pulses meet at point **C**.



2.1 Define the term pulse. (2)

2.2 Name the phenomenon which occurs when the pulses meet at **C**. (1)

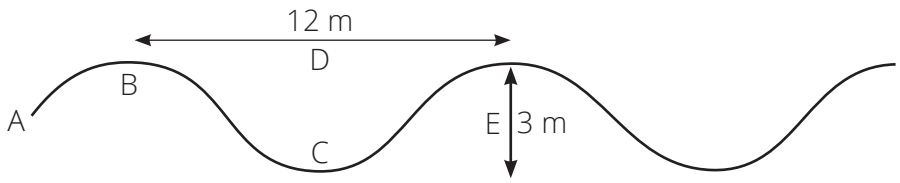
2.3 Draw a labelled sketch to show what occurs when the pulses meet at **C**. Indicate the pulse length and amplitude in your sketch. (3)

2.4 What happens to the pulses after they meet at **C**? (2)

[8]

Question 3

3.1 The diagram shows deep-sea waves in a calm ocean.



A boat floating in the ocean reaches its highest point every 8 s. The distance between two successive crests is 12 m. The difference between the highest and lowest point the boat reaches is 3 m.

3.1.1 How does the motion of the boat confirm that the waves in the ocean are transverse waves? (2)

3.1.2 Which letter in the diagram indicates a crest? (1)

3.1.3 What is the period of these waves? (2)

3.1.4 Calculate the speed of the waves. (3)

3.1.5 When the waves reach shallow water, they slow down. What happens to the wavelength? Just write INCREASES, DECREASES or REMAINS THE SAME. (2)

3.1.6 Why does the frequency stay the same, but not the wavelength? (3)

3.2 A group of learners investigated longitudinal waves in a spring.

3.2.1 Define *longitudinal wave*. (2)

3.2.2 Draw a labelled diagram to represent a longitudinal wave in a spring. Your sketch should show at least three compressions. Indicate the direction in which the wave is moving, as well as the direction in which the coils of the spring are moving. (3)

3.3 Briefly explain how a sound wave moves through air. (4)

[22]

Total section A: [40]

SECTION B: CHEMISTRY

Question 1

Multiple-choice questions: Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4). (i.e. 1.5 E)

1.1 Which one of the following is a chemical change?

A Water boils

B Sugar dissolves

C Bread bakes

D Gold melts (2)

1.2 Consider the following in a chemical reaction.

(i) atoms

(ii) mass

(iii) molecules

Which of these three are conserved in a chemical reaction?

A Only (ii)

B Only (i) and (ii)

C Only (i) and (iii)

D (i), (ii) and (iii) (2)

1.3 Look at the following equation.

$C_nH_{2n} + aO_2 \rightarrow bCO_2 + cH_2O$

The letters a, b and c represent numbers used to balance the equation, while *n* is the number of carbon atoms in the organic compound. Which of the following gives the relationship between *n* and c?

A 2n = c

B n = c

C n = 2c

D 4n = c (2)

1.4 Which of the following is NOT true concerning one mole of ammonium nitrate (NH_4NO_3)?

A It contains two moles of nitrogen atoms.

B It has a mass of 80 g.

C It contains $6{,}02 \times 10^{23}$ ions.

D It contains 3 moles of oxygen atoms. (2)

1.5 Iron filings and sulfur are heated together to form iron sulfide. Why is this considered a chemical change?

A There is a colour change.

B There is a phase change.

C A new substance is formed.

D The product is hard (2)

[10]

Question 2

2.1 The melting of ice is a physical change. Describe the rearrangement of molecules during this change. (2)

2.2 Classify each of the following as a physical or chemical change.

2.2.1 A few drops of food colouring are added to a glass of water to give it a colour. (1)

2.2.2 When a cake is baked, the baking soda releases carbon dioxide to make it rise. (1)

2.3 When 162,5 g iron(III) chloride ($FeCl_3$) reacts with 120 g sodium hydroxide (NaOH) that is dissolved in water, a reddish brown precipitate of iron(III) hydroxide and 175,5 g of NaCl, dissolved in water, is formed.

2.3.1 Apply the law of conservation of mass and calculate the mass of iron hydroxide that will form. (3)

2.3.2 Calculate how many chlorine atoms will combine with $4,2 \times 10^{27}$ iron atoms to form iron chloride. (3)

2.3.3 If 69 g Na atoms are present in the sodium chloride that formed, calculate the mass of Cl atoms present in the sodium chloride that formed. (2)

2.3.4 Write a balanced equation for this reaction. Use the appropriate method to indicate the phases of all reagents. (5)

2.4 Balance the following equations.

2.4.1 $CaCl_2 + AgNO_3 \rightarrow AgCl + Ca(NO_3)_2$ (2)

2.4.2 $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$ (3)

[22]

Question 3

3.1 What is the SI unit for amount of substance? (2)

3.2 26,2 g of sodium carbonate (Na_2CO_3) is dissolved in water to make 250 cm^3 of solution.

3.2.1 Calculate the molar mass of sodium carbonate. (3)

3.2.2 Calculate the concentration of the solution. (3)

3.3 The formula of hydrated cobalt chloride is $CoCl_2.4H_2O$.

30 gram of this hydrated salt is heated to remove the water of crystallisation.

Calculate the mass of water-free $CoCl_2$ that will remain. (4)

3.4 One litre of a 0,5 $mol{\cdot}dm^{-3}$ hydrochloric acid is neutralised by adding 35 g of calcium carbonate. The balanced equation for the reaction is as follows:

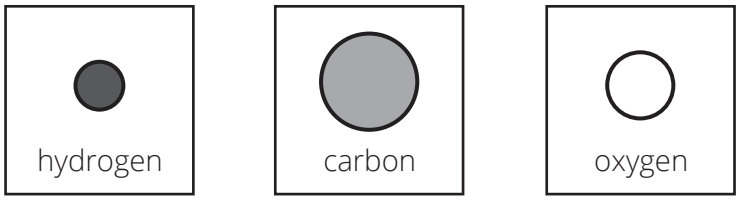
$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

Calculate the mass of dry calcium carbonate that will remain after all the acid has been neutralised. (6)

[18]

Question 4

Use the key below to answer questions that follow:



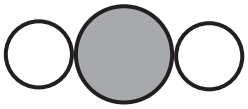
4.1 Draw diagrams of the following molecules.

4.1.1 Water. (3)

4.1.2 Ethane (C_2H_6) (3)

4.2 Write chemical formulae for the following molecules:

4.2.1



(2)

4.2.2

(2)

[10]

Total Section B: [60]

Total: [100]

Exemplar Assessments

Time: 2 hours

Final Year Examination Paper 1

Name: **Surname:**

Instructions

1. This question paper consists of SEVEN questions
2. Answer ALL questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

Question 1

Multiple-choice questions: Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4). (i.e. 1.5 E)

1.1 Peter-John travelled at an average velocity of 4 $m \cdot s^{-1}$. Which of the following is correct?

A His average speed must also be 4 $m \cdot s^{-1}$

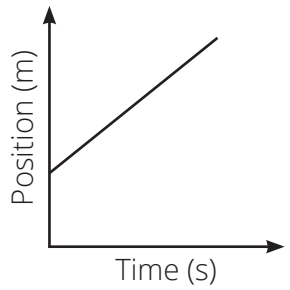
B His average speed can be smaller or equal to 4 $m \cdot s^{-1}$

C His average speed can be greater or equal to 4 $m \cdot s^{-1}$

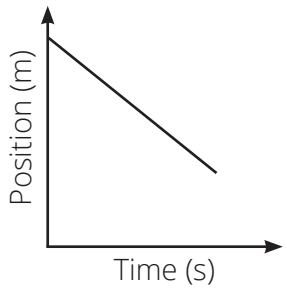
D His average speed can have any positive value (2)

1.2 Which of the following position–time graphs represent an object moving with a constant acceleration?

A

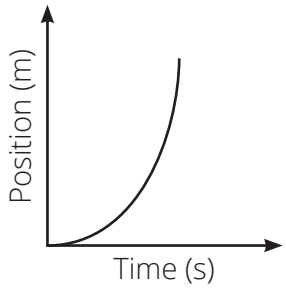


B

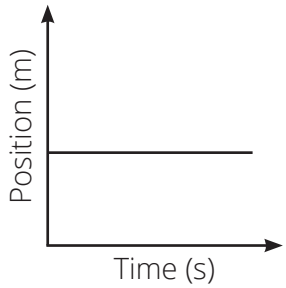


Time: 40 minutes

C



D



(2)

1.3 When a metal conductor becomes hot, its resistance increases. This is because ...

A the atoms expand with heat, therefore they are more in the way of the electrons.

B the forces between the atoms increase, making it difficult for electrons to pass.

C the atoms move further apart, so it is harder for electrons to move between them.

D the atoms vibrate more, so it is harder for electrons to move between them. (2)

1.4 Which one of the following statements regarding resistance is true? Resistance ...

A is a measure of the opposition to the flow of charge.

B is a measure of the rate of flow of charge.

C Is a measure of the amount of energy dissipated per charge unit in a resistor.

D increases with increasing thickness of a resistor. (2)

1.5 The bob on a pendulum reaches a maximum velocity of *v* after it is released from a height *h*. From what height does it have to be released to reach a maximum velocity of 2v?

A 1,5*h*

B $\sqrt{2}h^{-}$

C *2h*

D *4h* (2)

[10]

Question 2

A metal ball with a mass of 150 g is released on a track from a height of h_1. When it is a metre above the ground, its kinetic energy is 1,76 J.

2.1 Define kinetic energy. (2)

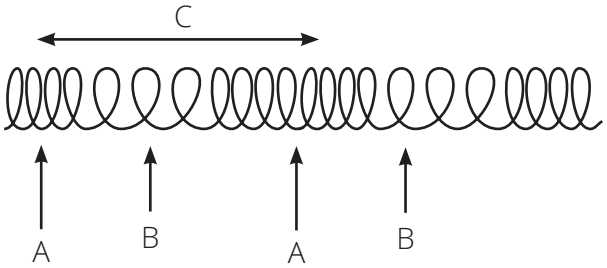
2.2 Ignore the influence of friction and calculate the height from which it was released. (5)

2.3 Calculate the velocity of the ball when it reaches the ground. (3)

[10]

Question 3

3.1 The diagram shows a longitudinal wave in a spring.



3.1.1 Give the appropriate labels for A, B and C on the diagram. (3)

3.1.2 A teacher produces longitudinal waves in a spring. The waves cover the 4 m length in 1,45 s. Exactly 2,5 waves are produced per second. Calculate the wavelength of the waves. (5)

3.2 You and a friend are given a drum and a stopwatch. You are asked to determine the speed of sound through the air. You can carry out the experiment on an open field, which is exactly 500 m long.

3.2.1 Explain how you will carry out the experiment. (2)

3.2.2 Calculate the speed of sound to the nearest metre, if the sound takes 1,49 seconds to travel 500 m. (3)

3.2.3 How will the speed of sound measured through water differ from the speed of sound measured through air? (1)

[14]

Question 4

A plant is left in a room. The only source of light is an orange light with a wavelength of 600 nm. An investigation showed that the plant utilises 30% of the energy from this light.

4.1 What is a photon? (2)

4.2 How many photons of this light will it take for the plant to store 475 kJ of energy in food? (4)

[6]

Question 5

5.1 Two 1,5 V cells are connected in series. They are then connected in series to a 4 Ω bulb, a switch and a combination of two 4 Ω resistors in parallel. Draw a circuit diagram of this circuit. Also include a voltmeter which will measure the potential difference over the cells and an ammeter which will measure the current through one of the 4 Ω resistors. (6)

5.2.1 Define *emf*. (2)

5.2.2 Determine the *emf* of the battery in this circuit. (1)

5.3 Except for the temperature of a resistor, name two other factors that can influence the magnitude of the resistance of a resistor. (2)

5.4.1 Calculate the resistance of the two 4 Ω resistors in parallel. (2)

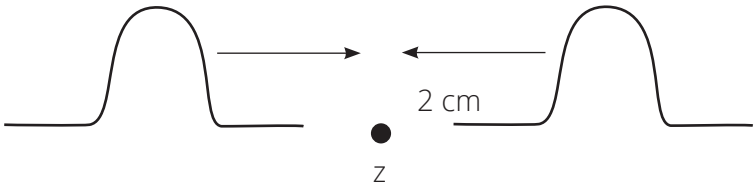
5.4.2 Calculate current flowing in the circuit. (4)

5.5 50 C of charge passes through a resistor in 10 s. The potential difference across the resistor is 2 V. Calculate the amount of energy that will be transferred by the current to the resistor in 10 s. (3)

[20]

Question 6

6.1 Two pulses with equal amplitudes move towards each other and reach the same point Z in a medium.



6.1.1 Explain what will happen when the pulses meet at point **Z**. (2)

6.1.2 What is the phenomenon observed in question 6.1.1 called? (1)

6.1.3 Explain what will happen after the pulses meet. (2)

6.2 A wave is created in a wave tank in an industrial laboratory. A float on the side of the tank moves up and down on a scale that shows its minimum height as 0,5 m and the maximum as 2,1 m.

6.2.1 Define the frequency of a wave. (2)

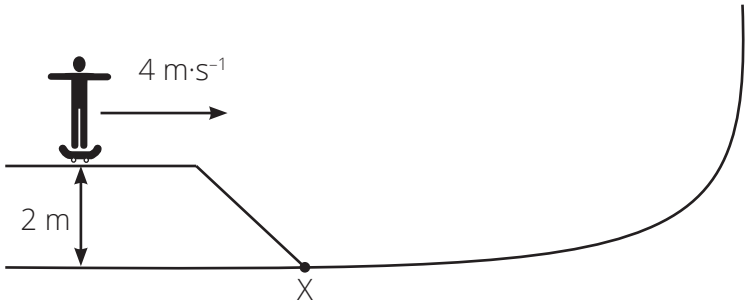
6.2.2 Explain why this is considered to be a transverse wave. (2)

6.2.3 Calculate the amplitude of the waves. (2)

[11]

Question 7

A boy with a mass of 70 kg is skateboarding. His path is represented in the diagram below. His velocity on the 2 m high platform is 4 m·s^{-1}, as indicated.



7.1 State the law of conservation of energy. (2)

7.2 Calculate the boy's kinetic energy while on the platform. (3)

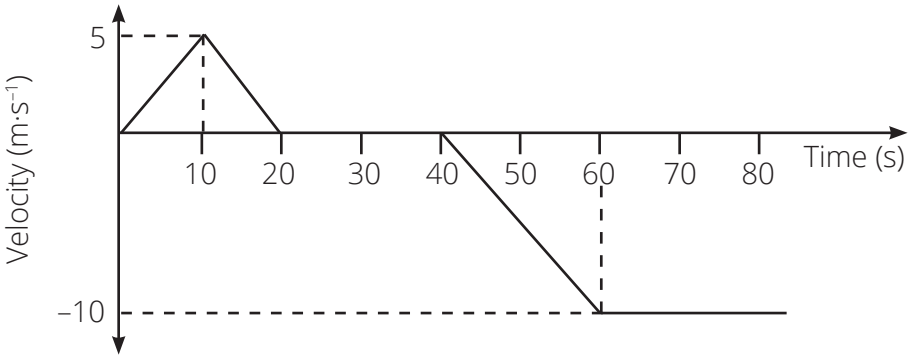
7.3 Calculate the boy's speed when he reaches point **X**. (4)

7.4 Calculate the maximum height the boy can reach on the opposite side. (4)

[13]

Question 8

The velocity–time graph below represents the motion of a train moving on a straight track. It initially moves in a southerly direction.



8.1 Describe carefully the train's motion during the first 40 seconds. (5)

8.2 At what time does the train reach its furthest point south from the beginning of the motion? (1)

8.3 During what time interval is the train moving at a constant non-zero velocity? (1)

8.4 Without using equations of motion, calculate the magnitude and direction of the train's acceleration during the first 10 seconds. (4)

8.5 Without using equations of motion, calculate the magnitude of the train's displacement after 80 seconds. (5)

[16]

Total: [100]

Exemplar Assessments

Time: 2 hours

Final Year Examination Paper 2

Name: **Surname:**

Instructions and information

1. This question paper consists of SEVEN questions
2. Answer ALL questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your final numerical answers to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

Question 1

Multiple-choice questions: Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4). (i.e. 1.5 E)

1.1 Which one of the following is a physical change?

A The combustion of hydrogen

B The rusting of a piece of iron

C The sublimation of CO_2(s)

D The decomposition of mercury oxide into its elements (2)

1.2 Why do halogens have high ionisation energies?

A They have many electrons

B They have full outer (valence) energy levels

C They have a high nuclear charge compared to their size

D They have large nuclei (2)

1.3 Which one of the following is not a property of metals?

A Good conductor of electricity

B Good conductor of heat

C Ductile
D Brittle (2)

1.4 Which of the following is NOT true for a chemical change?
A Mass is conserved
B Atoms are conserved
C Molecules are conserved
D There is a change in energy (2)

1.5 Which of the following substances is molecular?
A Lithium (Li)
B Oxygen (O_2)
C Silicate glass (SiO_2)
D Marble ($CaCO_3$) (2)

[10]

Question 2

2.1 Sulfur and iron filings are mixed. The mixture is heated and forms iron(II) sulfide.
2.1.1 What kind of mixture is the one mentioned above? (1)
2.1.2 Give a reason for your answer to question 2.1.1. (1)
2.1.3 Define a *compound*. (2)
2.1.4 Which of the substances mentioned above is a compound? (1)
2.1.5 Write down the formula of iron(II) sulfide. (2)

[7]

Question 3

3.1 The only stable isotope of phosphorus is phosphorus-31 (^{31}P).
3.1.1 Define *isotopes*. (2)
3.1.2 Draw the Aufbau diagram of the electron structure of phosphorus. (3)
3.1.3 Explain what is meant by the term *orbital*. (1)
3.1.4 What is the maximum number of electrons that can occupy an orbital? (1)
3.1.5 How many protons are there in a phosphorus-31 atom? (1)
3.1.6 Calculate the number of neutrons in a phosphorus-31 atom. (2)
3.1.7 Define *relative atomic mass*. (2)

3.2 Phosphorus combines with hydrogen to form phosphine (PH_3).
3.2.1 What type of bonding is found in phosphine? (1)
3.2.2 How does this kind of bonding form in phosphine? (3)
3.2.3 What kind of particles will phosphine be made of? (1)
3.2.4 Draw a Lewis diagram of phosphine (PH_3). (3)

[20]

Question 4

4.1 What is defined by 'number of moles per unit volume'? (1)

4.2 500 cm^3 of a 0,9 $mol.dm^{-3}$ copper nitrate ($Cu(NO_3)_2$) solution is prepared.

4.2.1 Calculate the molar mass of copper nitrate. (2)

4.2.2 Calculate the mass of copper nitrate that must be dissolved to make up this solution. (3)

4.3 The formula of hydrated copper sulphate is $CuSO_4.5H_2O$.

20 g of the water free $CuSO_4$ remains after the hydrated salt is heated to remove the water of crystallisation.

Calculate the mass of the hydrated salt that was heated. (4)

4.4 500 cm^3 of a 0,5 $mol{\cdot}dm^{-3}$ hydrochloric acid is neutralised by sodium hydroxide The balanced equation for the reaction is as follows:

$NaOH + HCl \rightarrow NaCl + H_2O$

Calculate the mass of dry sodium hydroxide needed to fully neutralize 500 cm^3 of the acid. (6)

[16]

Question 5

The periodic table is an orderly arrangement of elements according to their properties and structures.

5.1 Describe the trends in boiling points of substances in periods 2 and 3 of the periodic table from left to right. (3)

5.2 Identify the halogen in period 2 and then draw the Aufbau diagram of its electron structure. (3)

5.3 How is the ionisation energy of metals related to their reactivity? (2)

5.4 Both sodium and chlorine are found in the third period of the periodic table.

5.4.1 Which one of sodium or chlorine will have the highest electronegativity? (1)

5.4.2 Refer to the definition of electronegativity as well as the electron structure of the atoms and explain your answer to question 5.4.1. (3)

[12]

Question 6

When pollen that is suspended in water is viewed through a microscope, Brownian motion is observed.

6.1 Describe what you will observe. (2)

6.2 Use the kinetic molecular model of liquids to explain this motion. (3)

6.3 Why can Brownian motion not be observed in solids? (2)

[7]

Question 7

7.1 Write down the Law of constant composition. (2)

7.2 Hydrogen gas and nitrogen gas are used to make ammonia gas (NH_3)

7.2.1 Calculate the percentage composition of hydrogen in ammonia. (3)

7.2.2 Write down a balanced equation representing the reaction between hydrogen gas and nitrogen gas to form ammonia. (3)

7.2.3 Calculate the number of moles of ammonia in 20 g of ammonia gas. (3)

7.2.4 Calculate the volume that 20 g of ammonia gas would occupy at standard temperature and pressure (STP). (3)

7.3 Aluminium reacts with HCl gas to give aluminium chloride and hydrogen gas:

$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

If 20 g of aluminium reacts with an excess of HCl, calculate the theoretical yield (in g) of hydrogen gas that forms. (6)

7.4 A compound consists of 40% carbon, 6,65% of hydrogen and 53,35% oxygen.

Determine the empirical formula of the compound. (5)

7.5 By performing the necessary calculations, prove that mass is conserved in when the following reaction takes place:

$2H_2O_2 \rightarrow 2H_2O + O_2$ (3)

[28]

Total: [100]

Exemplar Assessments

Time: 40 minutes

Term 2 Control Test

MEMORANDUM

1.1 B✓✓ (2)

1.2 B✓✓ (2)

1.3 D✓✓ (2)

1.4 C✓✓ (2)

1.5 D✓✓ (2)

[10]

2.1 $V_{tot} = V_1 + V_2$ ✓

$27 = 18 + V_2$

$V_2 = 9$ V ✓ (2)

2.2 Less than ✓ (1)

2.3 The total current passes through A_1 ✓ whereas only a part of the current passes through A_2. ✓ (2)

2.4 $\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R}$ ✓

$\frac{1}{1,5} = \frac{1}{R} + \frac{1}{R}$

$R = 3\ \Omega$ ✓ (2)

2.5 $Q = It$ ✓

$= 6 \times 20$

$= 120$ C ✓ (2)

2.6 The same as ✓ (1)

2.7 When the switch is open, ✓ the bulbs are connected in series ✓ and the current in a series circuit is the same everywhere. ✓✓ (4)

[14]

3.1.1 Acceleration is the rate of change in velocity. ✓✓ (2)

3.1.2 Period of timer $T = \frac{1}{f}$ ✓

$= \frac{1}{50}$ ✓

$= 0,02$

$3\,T = 3 \times 0,02$ ✓

$= 0,06$ s ✓ (4)

3.1.3 Instantaneous v at E = average v from D to F

$\therefore v = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{41 + 53}{0,04}$ ✓ or $\frac{0,041 + 0,053}{0,04}$

$= 2\,350\ \text{m·s}^{-1}$

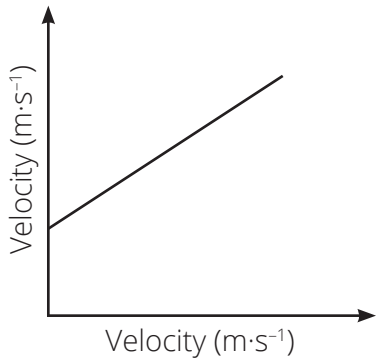
$= 2,35\ \text{m·s}^{-1}$ ✓ (3)

3.1.4 $a = \frac{v_t - v_i}{\Delta t}$ ✓

$= \frac{2{,}35 - 0{,}55}{0{,}06}$ ✓

$= 30\ m{\cdot}s^{-2}$ ✓ (3)

3.1.5



✓: axes correctly labelled and in the right position

✓: graph starts above 0

✓: positive gradient (3)

3.2.1 $v_f^2 = v_i^2 + 2a\Delta x$ ✓

$32^2 = 99^2 + 2(-52)\Delta x$ ✓

$\Delta x = 84{,}39$

∴ 84,39 m before the bend. ✓ (3)

3.2.2 $v_f = v_i + a\Delta t$ ✓

$69{,}5 = (30) + a(6{,}59)$ ✓

$a = 5{,}99\ m{\cdot}s^{-2}$ ✓ (3)

3.3.1 From rest the train accelerates uniformly westward for 60 seconds, reaching a top speed of 30 $m{\cdot}s^{-1}$. ✓ It then continues with constant velocity, until 240 seconds later, ✓ when it slows down with uniform acceleration until it stops in the course of a further 60 s. ✓ (3)

3.3.2 The total distance travelled = area underneath the graph ✓

$= \frac{1}{2}(60)(30) + (240 - 60)(30) + \frac{1}{2}(60)(30)$ ✓ $+ \frac{1}{2}(60)(20)$

$(600 - 480)(20) +$ ✓ $\frac{1}{2}(60)(20)$ ✓

$= 12\ 000$ m ✓

(4)

3.3.3 After 300 s (1)

3.3.4 Average velocity $= \frac{\text{total displacement}}{\text{total time}}$ ✓

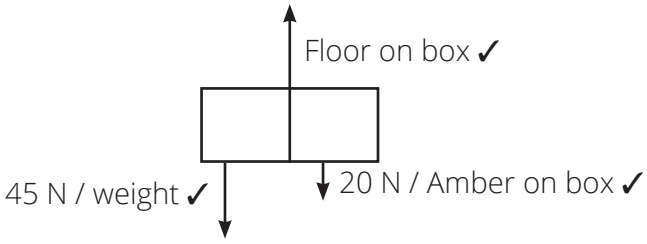
$$\frac{\frac{1}{2}(60)(30) + (240 - 60)(30) + \frac{1}{2}(60)(30) + \frac{1}{2}(60)(-20) + (660 - 480)(-20) + \frac{1}{2}(60)(-20)}{720}$$

$= 3{,}33\ m{\cdot}s^{-1}$ ✓ (4)

[33]

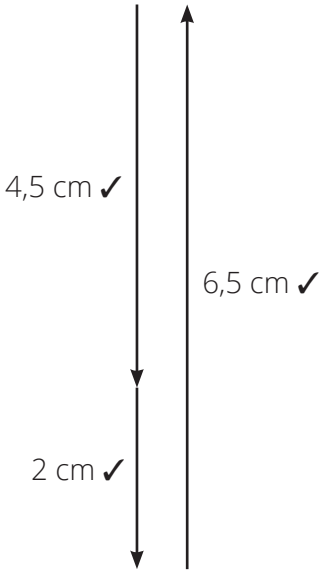
4.1.1 A resultant is the single vector having the same effect as two or more vectors together. ✓✓ (2)

4.1.2



(3)

4.1.3



6,5 cm ✓: 65 N ✓ (Accept 64 to 66) (4)

4.1.4 Decrease ✓ (1)

4.2.1 A frame of reference is a reference point from where positions are measured ✓ (like Keasha's house in this case) and a set of directions ✓ (such as north and south). ✓ (3)

4.2.2 Take south as positive: ✓

200 – 750 – 900 ✓

= –1 450 m ✓

= 1 450 m ✓ north ✓

OR

Take north as positive: ✓

–200 + 750 – 900 ✓

= 1 450 m ✓ north ✓ (4)

4.2.3 Average velocity will be equal to the total distance they walked, divided by the total time it took. ✓ The instantaneous velocity changes all the time and will be zero when they stop and talk to friends, ✓ but higher when they walk. ✓ (3)

4.2.4 Average velocity $= \frac{\text{total displacement}}{\text{total time}}$ ✓

$= \frac{1\ 450 \text{ north}}{(3 + 2 + 10\ 12) \times 60}$

$= \frac{1\ 450}{1\ 620}$

$= 0{,}9\ \text{m·s}^{-1}$ north ✓ (3)

[23]

5.1 Mechanical energy is the sum of the gravitational potential energy and kinetic energy of an object. ✓✓ (2)

5.2 The system does not interact with its surroundings, ✓ so there is no transfer of energy or mass between the system and the surroundings. ✓ ✓ (3)

5.3 It is the same. ✓ Mechanical energy is conserved, ✓ because it is an isolated, frictionless system. ✓ (3)

5.4 $E = mgh + \frac{1}{2}mv^2$ ✓

$= (600)(9{,}8)(10)$ ✓ $+ \frac{1}{2}(600)(6)^2$

$= 69\ 600$ J ✓ (= 69 kJ) (4)

5.5 $E = mgh + \frac{1}{2}mv^2$ ✓

$69\ 600 = (600)(9{,}8)(5) + \frac{1}{2}(600)(6)v^2$ ✓

$v^2 = 134$

$v = 11{,}58\ \text{m·s}^{-1}$ ✓ (4)

5.6 $E_p = mgh$

$= (600)(9{,}8)(20)$ ✓

$= 117\ 600$ J ✓

$> E_m$ ✓

∴ the cart will not be able to reach point C. ✓ (4)

[20]

Total: [100]

Time: 2 hours

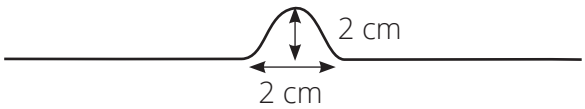
Term 3 Control Test

MEMORANDUM

SECTION A: PHYSICS

1.1 C✓✓ (2)
1.2 D✓✓ (2)
1.3 C✓✓ (2)
1.4 C✓✓ (2)
1.5 C✓✓ (2)
[10]

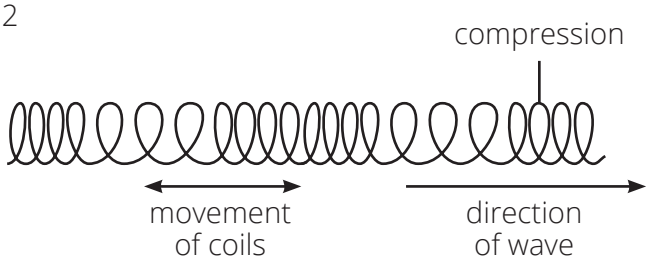
2.1 A pulse is a single disturbance in a medium. ✓✓ (2)
2.2 (Destructive) interference / superposition. ✓ (1)
2.3



pulse length 2 cm ✓
amplitude 2 cm ✓
single pulse upward ✓ (3)
2.4 They continue unchanged ✓ in the same directions as before. ✓ (2)
[8]

3.1.1 The boat moves up and down ✓ on the waves while the wave moves horizontally, ✓ i.e. boat moves perpendicular to the direction of the wave. (2)
3.1.2 B ✓ (1)
3.1.3 8 s ✓✓ (2)
3.1.4 $v = \frac{\Delta x}{\Delta t}$ ✓
$= \frac{12}{8}$ ✓
$= 1{,}5\ m{\cdot}s^{-1}$ ✓ (3)
3.1.5 Decreases✓✓ (2)
3.1.6 The speed of a wave is equal to the product of its wavelength and frequency. ✓ The frequency is caused by the source of the wave and remains unchanged. ✓ Therefore, if the speed of the wave decreases, it means the wavelength of the wave will also decrease. ✓ (3)
3.2.1 A longitudinal wave is a wave in which the particles of the medium vibrate parallel to the direction of motion of the wave. ✓✓ (2)

3.2.2



(3)

3.3 Air particles vibrate ✓ parallel to the direction of movement of wave ✓ and collide with next air particles. Compressions ✓and rarefactions passed on ✓ (4)

[22]

Total Section A: [40]

SECTION B: CHEMISTRY

1.1 C✓✓ (2)

1.2 B✓✓ (2)

1.3 B✓✓ (2)

1.4 C✓✓ (2)

1.5 C✓✓ (2)

[10]

2.1 Molecules which were arranged in an orderly manner ✓ move away from each other and start moving around in a disorderly manner. ✓ (2)

2.2.1 Physical ✓ (1)

2.2.2 Chemical ✓ (1)

2.3.1 Total mass of reactants = total mass of products
162,5 + 120 ✓ = iron hydroxide + 175,5 g ✓
Mass iron hydroxide that forms = 107 g ✓ (3)

2.3.2 Iron and chlorine combine in the ratio 1:3.
∴ the number of chlorine atoms = 3 ✓× $4,2 \times 10^{27}$ ✓
= $1,26 \times 10^{28}$ ✓ (3)

2.3.3 175,5 – 69 ✓ = 106,5 g ✓ (2)

2.3.4 $FeCl_3$ ✓ + 3NaOH(aq) ✓ → $Fe(OH)_3$(s) ✓ + 3NaCl(aq) ✓ ✓
(1 mark for every phase and formula indicated correctly and 1 mark for balancing of equation.) (5)

2.4.1 $CaCl_2 + 2AgNO_3$ ✓ → $2AgCl + Ca(NO_3)_2$ ✓ (2)

2.4.2 $2C_4H_{10}$ ✓ + $13O_2$ ✓ → $8CO_2 + 10H_2O$ ✓ (3)

[22]

3.1 mole ✓✓ (2)

3.2.1 2 ✓× 23 + 12 + 3 × 16 ✓ = 106 g·mol–1 ✓ (3)

3.2.2 $c = \frac{m}{MV}$ ✓

$= \frac{26,2}{(106)(0,25)}$ ✓

$= 0,99\ mol{\cdot}dm^{-3}$ ✓ (3)

3.3 $M(CoCl_2{\cdot}4H_2O) = 59 + 35,5 \times 2 + 4 \times 18$

$= 202$ ✓

$M(CoCl_2) = 59 - 35,5 \times 2$

$= 130$ ✓

$\frac{130}{202} \times 30$ ✓ $= 19,31$ g ✓ (4)

3.4 0,5 mol HCl neutralises 0,25 mol $CaCO_3$ ✓

$M(CaCO_3) = 40 + 12 - 3(16)$ ✓

$n = \frac{m}{M}$ ✓

$m = 0,25 \times (40 + 12 + 3 \times 16)$ ✓

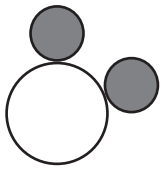
$= 25$ g ✓

Mass $CaCO_3$ remaining = 35 –25

= 10 g ✓ (6)

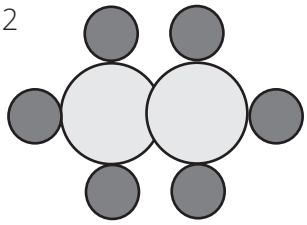
[18]

4.1.1



✓: Shape ; ✓: 2 H atoms ; ✓ O atom (3)

4.1.2



✓: Shape ; ✓: 2 C atoms ; ✓2 H atoms (3)

4.2.1 CO_2 ✓✓ (2)

4.2.2 H_2O_2 ✓✓ (2)

[10]

Total section B: [60]

Total: [100]

Exemplar Assessments

Time: 2 hours

Final Year Examination Paper 1

MEMORANDUM

1.1 C✓✓ (2)

1.2 C✓✓ (2)

1.3 D✓✓ (2)

1.4 A✓✓ (2)

1.5 D✓✓ (2)

[10]

2.1 Kinetic energy is the energy an object possesses as a result of its motion. ✓✓ (2)

2.2 $E_{m\ 1\ metre} = mgh + \frac{1}{2}mv^2$✓

$= (0.15)(9,8)(1) + (1,76)$✓

$= 3,23$ J

$E_{m\ top} = mgh + \frac{1}{2}mv^2$

$3,23 = (0,15)(9,8)h + 0$✓

$h = 2,20$ m✓ (5)

2.3 $(mgh + \frac{1}{2}mv^2)_{bottom} = E_{m\ top}$ ✓

$0 + \frac{1}{2}(0,15)v^2 = 3,23$ ✓

$v = 6,56\ m{\cdot}s^{-1}$ ✓ (3)

[10]

3.1.1 A: compression ✓

B: rarefaction ✓

C: wavelength ✓ (3)

3.1.2 $v = \frac{\Delta x}{\Delta t}$ ✓

$= \frac{4}{1,45}$ ✓

$= 2,759$ s

$v = f\lambda$ ✓

$2,759 = (2,5)\lambda$ ✓

$\lambda = 1,10$ m ✓ (5)

3.2.1 One beats the drum at one end of the field, while the other stands at the other end of the field ✓ and measures the time from when he sees the drumbeat until he hears it. ✓ (2)

3.2.2 Speed $= \frac{\text{distance}}{\text{time}}$ ✓

$= \frac{500}{1,49}$ ✓

$= 336\ m{\cdot}s^{-1}$ ✓ (3)

3.2.3 Sound travels at a higher speed through water than through air. ✓ (1)

[14]

4.1 A photon is a packet of light energy. ✓✓ (2)

4.2 $E = \frac{hc}{\lambda}$ ✓

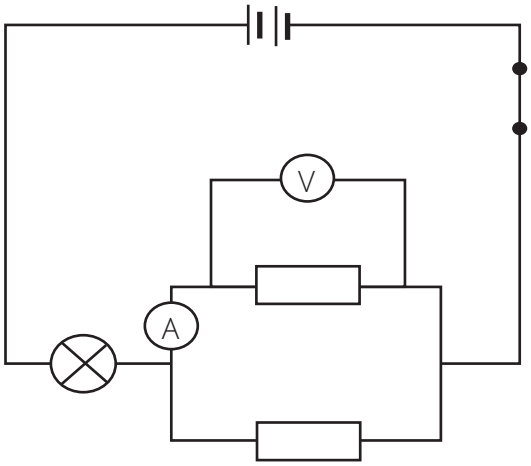
$= \frac{(6{,}63) \times 10^{-34})\ (3 \times 10^{8}}{600 \times 10^{-9}}$ ✓

$= 3{,}315 \times 10^{-19} \times 0{,}3 \times n = 475$ ✓

$n = 4{,}78 \times 10^{21}$ photons ✓ (4)

[6]

5.1



two cells in series ✓
light bulb ✓
resistors in parallel ✓
switch ✓
voltmeter ✓
ammeter ✓

(6)

5.2.1 emf is the potential difference across a cell or battery when no charge is flowing through it. ✓✓ (2)

5.2.1 3 V ✓ (1)

5.3 Type of material of which a resistor is made ✓
Thickness of the resistor ✓
Length of the resistor ✓ (Any two) (2)

5.4.1 $\frac{1}{R} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4}$ ✓

$R = \frac{4}{2} = 2\ \Omega$ ✓ (2)

5.4.2 $I = \frac{V}{R}$ ✓ $= \frac{3}{(2+4)}$ ✓ ✓ $= 0{,}5\ A$ ✓ (4)

5.5 $W = QV$ ✓
$= 50 \times 2$ ✓
$= 100$ J ✓ (3)

[20]

6.1.1 The two displacements will create one big pulse ✓ and the amplitude will be the sum of the amplitudes of the initial two pulses. ✓ (2)

6.1.2 Constructive interference / superposition ✓ (1)

6.1.3 They will both continue in their original directions ✓ with their original amplitudes ✓ and speed. (2)

6.2.1 The number of complete waves passing a given point per second. ✓✓ (2)

6.2.2 The wave travels horizontally, ✓ while the float moves vertically. ✓

OR

The wave travels in a direction perpendicular to the direction that the particles of the water travel. (2)

6.2.3 $\frac{2,1 - 0,5}{2}$ ✓

= 0,8 m (Full marks if only answer is given) ✓ (2)

[11]

7.1 The total energy of an isolated system remains constant. ✓✓ (2)

7.2 $E_k = \frac{1}{2}mv^2$ ✓

$= \frac{1}{2}(70)(4)^2$ ✓

= 560 J ✓ (3)

7.3 $E_{m(start)} = E_{m(bottom)}$ ✓

$(70)(9,8)(2) + 560$ ✓ $= 0 + \frac{1}{2}v^2(70)$ ✓ (if 0 is omitted, the marl is still awarded.)

$v^2 = 55,2$

$v = 7,43\ m{\cdot}s^{-1}$ ✓ (4)

7.4 $E_{m(bottom)} = E_{m(top)}$ ✓

$0 + \frac{1}{2}(70)(7,43)^2 = (70)(9,8)h - 0$ ✓

$h = 2,82$ m ✓ (4)

[13]

8.1 The train moves from rest ✓in a southerly direction and accelerates uniformly ✓ for 10 , reaching a top speed of 5 $m{\cdot}s^{-1}$, before immediately slowing down steadily, ✓ coming to rest again after another 10 s ✓, and remaining at rest for a further 20 s. ✓ (5)

8.2 t = 20 s ✓ (1)

8.3 60 to 80 seconds ✓ (1)

8.4 Acceleration = gradient of the graph ✓

$= \frac{5 - 0}{10 - 0}$ ✓

= 0,5 $m{\cdot}s^{-2}$ ✓ south ✓ (4)

8.5 Displacement = area under graph ✓

$= \frac{1}{2}(20)$ ✓ $+ \frac{1}{2}(20)(-10)$ ✓ $+ (20)(-10)$ ✓

$= -250$

∴ 250 m ✓ (5)

[16]

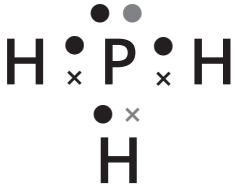
Total: [100]

3.2.1 Covalent ✓ (1)

3.2.2 An electron from a half-filled phosphorus orbital and one from a hydrogen atom ✓ is shared by the two atoms. ✓ The nuclei of both atoms attract the shared electrons. ✓ In the phosphine molecule there are three shared electron pairs between hydrogen and phosphorus. (any three) (3)

3.2.3 Molecules ✓ (1)

3.2.4



(3)

[20]

4.1 concentration ✓ (1)

4.2.1 $M(Cu(NO_3)_2)$= 63,5 + 2(14 + 16 x 3) ✓= 187,5 ✓ (2)

4.2.2 m = cMV ✓= 0,9 x 187,5 x 0,5 ✓= 84,38 g ✓ (3)

4.3 $M(CuSO_4)$ = 63,5 + 32 + 16 x 4 = 159,5 ✓

$M(CuSO_4.5H_2O)$ = 159,5 + 5(2 x 1 + 16) = 249,5 ✓

mass heated = $20 \times \frac{249,5}{159,5}$ ✓ = 31,29 g ✓ (4)

4.4 n(HCl) = c V = 0,5 x 0,5 ✓ = 0,25 mol. ✓

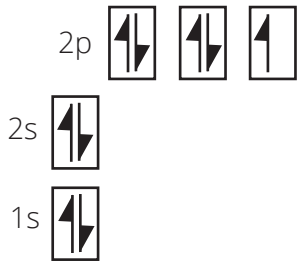
0,25 mol HCl is neutralized by 0,25 mol NaOH ✓

m(NaOH) = n.M ✓= 0,25 × 40 ✓ = 10 g ✓ (6)

[16]

5.1 The boiling points first increase ✓ as you go across period 2 and then decrease ✓ to neon. This repeats as you go across period 3. ✓ (3)

5.2 Fluorine (F) ✓



(3)

5.3 The smaller the ionisation energy, ✓ the more reactive they are. ✓ (2)

5.4.1 Chlorine ✓ (1)

5.4.2 Electronegativity is a measure of the attractive force that an atom might have on a shared electron pair. ✓ Since there are more protons in the nucleus of chlorine than of sodium, ✓ chlorine will have a stronger attractive force on the electrons in the same energy level ✓ than sodium. (3)

[12]

6.1 The pollen particles move randomly ✓ and change direction regularly. ✓ (2)

6.2 Water consists of invisible molecules ✓ which move constantly. ✓ They collide with the pollen, causing them to move. ✓ (3)

6.3 The molecules (particles) in solids do not move around enough ✓ and there will not be space for particles in the solid to move around visibly. ✓ (2)

[7]

7.1 The law of constant composition or constant proportions states that all samples of a given chemical compound have the same elemental composition. ✓✓ (2)

7.2.1 (3 × 1) ✓ / 17 ✓ × 100 = 17,65 %✓ (3)

7.2.2 $N_2 + 3H_2 \rightarrow 2\ NH_3$ ✓✓✓ (3)

7.2.3 n = m/M ✓= 20 /17 ✓= 1,18 mol. ✓ (3)

7.2.4 Volume = 1,18✓ × 22,4 ✓ = 26,43 dm^3✓ (3)

7.3 n = m/M = 20 / 27 ✓ = 0,74 mol. ✓

2 mol Al yields 3 mol H_2 ✓

n H_2 = (0,74/2) × 3 = 1,11 mol ✓

m = nM = 1,11 × 2 ✓= 2,22 g ✓ (6)

7.4 C: 40/12 = 3,333 ✓

H: 6,65 / 1 = 6,65✓

O: 53,35 / 16 = 3,334 ✓

D

C:H:O = 3,333/3,333 : 6,65/3,33 : 3,334/3,33 = 1:2:1 (*Divide by 3,33* ✓)

Empirical formula = C H_2 O ✓ (5)

7.5 Mass reactants: 2(34) = 68 g ✓ Mass products: 2(18) + 16 = 68 g ✓

Mass reactant = mass products ✓ ∴ mass is conserved. (3)

Total: [100]

Notes

Notes

Notes

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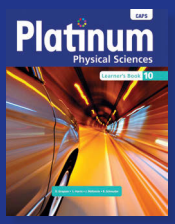

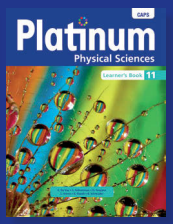

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