basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

# TECHNICAL SCIENCES

## GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

## GRADE 12

## 2021

**These guidelines consist of 19 pages.**

# TABLE OF CONTENTS

## 1. INTRODUCTION

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, Mechanical Technology, Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the examination mark at the end of the year. The practical assessment task for Technical Sciences Grade 12 consists of THREE experiments. The experiments are COMPULSORY for ALL candidates offering Technical Sciences in Grade 12. The practical component counts 25% of the final promotion mark.

The PAT is implemented during the first three terms of the school year. The formal experiments allow learners to be assessed regularly during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, such as tests or examinations. It is therefore important that schools ensure that all learners complete the practical assessment tasks within the stipulated period to ensure that learners are promoted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

 

## 2. TEACHER GUIDELINES

### 2.1 How to administer the PATs

- The following documents must be available for all formal experiments:
    - Instructions sheets explaining the procedures to be followed for the experiments
    - The worksheets consisting of questions to be answered under supervision
    - The teacher guidelines with instructions sheets, worksheets and marking guidelines (The teacher guidelines should NOT be released to the learners.)

    **NOTE: Teachers should compile marking guidelines (memoranda) for the actual results of the experiments conducted (teachers should perform the experiments prior to the learners performing the experiments.)**

- The teacher should hand out ONLY the Instruction Sheet for the conduct of the experiment.
- The experiments should be performed individually or in pairs.
- In cases where there is insufficient apparatus, the experiments can be performed in groups.
- Each learner should record his/her OWN data or observations.
- Each learner should be provided with the worksheet to answer the questions under supervision conditions.
- Only once all the learners have performed the experiment and they are ready to answer questions under supervision conditions, should teachers hand out a worksheet to each learner.
- If it is not possible to perform the experiment and complete the worksheet on the same day, the teacher should keep the data collected by the learners at the school after a part of the experiment has been done. The data should only be handed back to the learners when they have to complete the worksheet.

### 2.2 Moderation of the PATs

The experiments should be administered under supervised conditions. Moderation of the experiments may take place on site and can include learners redoing the experiments in the presence of the moderator.

**For moderation the following are required either in a separate class or in a laboratory:**

- List of names of learners who are sampled for district moderation
- Equipment/Apparatus/Chemicals placed ready at workstations
- Instruction sheets and worksheets (empty) for sampled learners to answer questions

**For moderation the following documents are required in the teacher's file:**

- Index stating all tasks with raw and weighted marks
- All instruction sheets for all experiments
- Marking guidelines for all experiments
- Composite working mark sheet for all learners showing raw and weighted marks
- Evidence of internal moderation

**For moderation the following documents are required in the learner's file:**

- Index stating all tasks with raw and weighted marks
- Answer sheets for all experiments
- Declaration of authenticity

 

## 3. LEARNER GUIDELINES

3.1 This PAT for Grade 12 consists of THREE experiments.

3.2 Compilation of the PAT should start in Term 1, monitored through Terms 2 and 3 and be completed in Term 3.

3.3 The PAT counts 25% of the final promotion mark for Grade 12.

3.4 All the work in the PAT must be the learner's own work. Group work will NOT be allowed.

3.5 Show ALL calculations clearly and include units. Round off answers to a minimum of TWO decimal places. Use correct SI units.

## 4. EVIDENCE OF MODERATION

**LEARNER'S NAME:** _____

**SCHOOL:** _____

| MODERATION | SIGNATURE OF TEACHER | DATE | SIGNATURE OF HOD | DATE |
|---|---|---|---|---|
| **SCHOOL-BASED** | | | | |

| PRACTICAL COMPONENT: EXPERIMENT | MAXIMUM MARK | WEIGHTING | LEARNER'S MARK (TEACHER) | MOD. MARK (SCHOOL) | MOD. MARK (DISTRICT) | MO. MARK (PROVINCE) |
|---|---|---|---|---|---|---|
| **1** | **45** | **40** | | | | |
| **2** | **35** | **30** | | | | |
| **3** | **30** | **30** | | | | |
| **TOTAL** | **110** | **100** | | | | |

SCHOOL STAMP

 

**5. PAT MARK SHEET 2021**

| TECHNICAL SCIENCES GRADE 12<br>PAT MARK SHEET 2021 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | TERM 1 | | TERM 2 | | TERM 3 | | TOTAL PAT |
| | | | Experiment 1: PAT | | Experiment 2: PAT | | Experiment 3: PAT | | |
| | | | Raw | Weighted | Raw | Weighted | Raw | Weighted | |
| **No.** | **SURNAME** | **NAME** | **45** | **40** | **35** | **30** | **30** | **30** | **100** |
| 1. | | | | | | | | | |
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| 22. | | | | | | | | | |
| 23. | | | | | | | | | |
| 24. | | | | | | | | | |
| | | **Average** | | | | | | | |

## 6. DECLARATION OF AUTHENTICITY

**NAME OF SCHOOL: ..……..**

**NAME OF LEARNER: ……..……...**
**(FULL NAME(S) AND SURNAME)**

**CLASS: ……..…….**

**NAME OF TEACHER: ……**

I hereby declare that the tasks submitted for assessment is my own original work and have not been submitted for assessment or moderation previously.

_____ _____
**SIGNATURE OF CANDIDATE** **DATE**

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his/her own.

_____ _____
**SIGNATURE OF TEACHER** **DATE**

SCHOOL STAMP

## 7. CONCLUSION

On completion of the practical assessment task learners should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops learners' life skills and provides opportunities for learners to engage in their own learning.

## 8. EXPERIMENT INSTRUCTIONS AND WORKSHEETS

### EXPERIMENT 1

### 1. TITLE: PRINCIPLE OF CONSERVATION OF LINEAR MOMENTUM

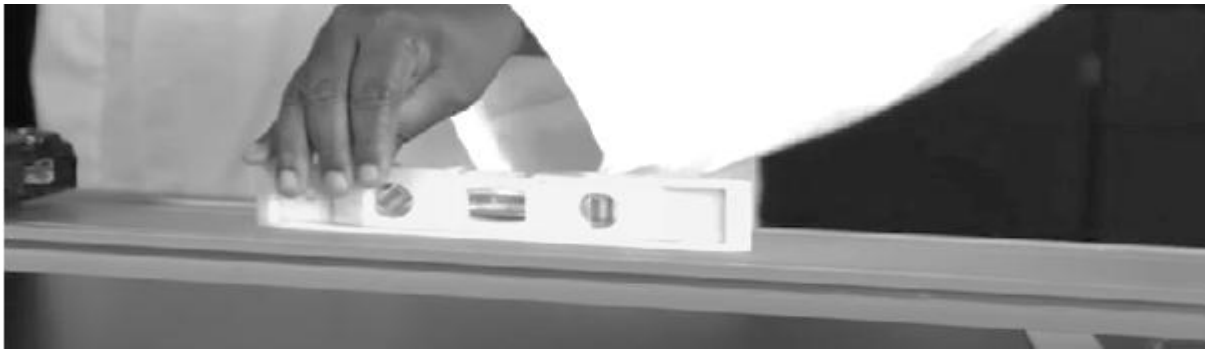
**2. AIM:** To verify the principle of conservation of linear momentum

### 3. APPARATUS/EQUIPMENT

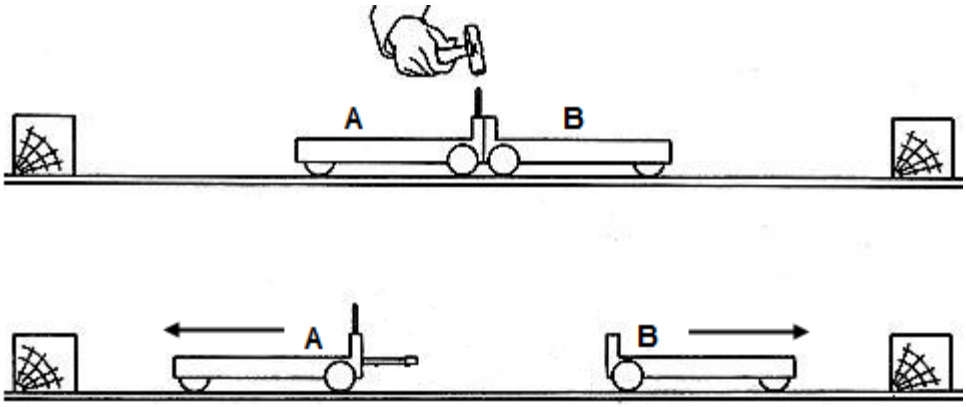
- Runway/Track
- Two trolleys with compressible spring and plunger/buffer rod
- Stop watch/Timer
- Spirit level
- Mass balance
- Ruler/Meter stick/Measuring tape
- 250 g mass piece

### 4. PROCEDURE

Use a spirit level to ensure that the track is level longitudinally and sideways, as illustrated below.



Arrange the apparatus as illustrated in the diagram below.




- Clean the runway and trolley wheels to remove any dirt.
- Ensure that the mass balance (digital/manual) is at zero before measuring the mass of the trolleys.
- Measure and record the mass of each trolley.
- Place the two trolleys on the runway.
- Release one of the buffer rods by tapping the release rod. The trolleys should move apart.
- Ensure that the trolleys hit the barriers simultaneously.
- In case the trolleys do not hit the barriers simultaneously, change the initial position until they hit the barriers at the same time.
- Mark the initial position and measure the distance between the initial position and the barriers for each trolley.
- Repeat this procedure THREE times.
- Record the:
  - Distance between the initial position and the barriers for each trolley
  - Time taken to hit the barriers
- Place a (250 g) mass piece on top of one of the trolleys.
  - Measure the mass of the trolley and the mass piece.
  - Repeat bullets 4 to 10.

**WORKSHEET FOR THE CONSERVATION OF LINEAR MOMENTUM**

1. **PRACTICAL SKILLS**

| CRITERIA | MARKS |
|---|---|
| Precaution:<br>• Cleaning the runway and the wheels of the trolleys<br>• Ensuring that the mass balance (digital/manual) is at zero before measuring the mass of the trolleys | 2 |
| Set-up:<br>• Ensuring that the track/rail is level longitudinally<br>• Ensuring that the track/rail is level sideways<br>• Locating a suitable starting position for the two trolleys so that they hit the barriers simultaneously<br>• Marking the initial position | 4 |
| Measuring skills:<br>• Measurements of the masses of the trolleys<br>• Measuring the distance between the starting position and the barrier for each trolley accurately<br>• Using the timer or stopwatch (start, stop) accurately | 3 |
| **TOTAL** | **9** |

2. Give ONE possible experimental error. (1)

3. Suggest how the error given in QUESTION 2 can be prevented. (1)

4. **DATA REPRESENTATION AND INTERPRETATION OF RESULTS**

Using trolleys without mass piece:

| TRIAL | TROLLEY | MASS (kg) | TIME (s) | DISTANCE (m) (between initial position and barrier) |
|---|---|---|---|---|
| 1 | **A** | | | |
| | **B** | | | |
| 2 | **A** | | | |
| | **B** | | | |
| 3 | **A** | | | |
| | **B** | | | |
| Average | **A** | | (1) | (1) |
| | **B** | | (1) | (1) |

Using trolleys with mass piece in one of the trolleys:

| TRIAL | TROLLEY | MASS (kg) | TIME (s) | DISTANCE (m) (between initial position and barrier) |
|---|---|---|---|---|
| 1 | **A** | | | |
| | **B** | | | |
| 2 | **A** | | | |
| | **B** | | | |
| 3 | **A** | | | |
| | **B** | | | |
| Average | **A** | | (1) | (1) |
| | **B** | | (1) | (1) |

**QUESTIONS 5 to 7 refer to the use of the trolleys without the mass piece.**

5. What is the initial velocity of the system? (1)

6. Calculate the:

   6.1 Velocity ($v_f$) of trolley **A** after the explosion (3)

   6.2 Velocity ($v_f$) of trolley **B** after the explosion (2)

7. Calculate the total momentum:

   7.1 Before the explosion (3)

   7.2 After the explosion (4)

**QUESTIONS 8 to 11 refer to the use of the trolleys with a mass piece.**

8. Calculate the:

   8.1 Velocity ($v_f$) of trolley **A** after the explosion (2)

   8.2 Velocity ($v_f$) of trolley **B** after the explosion (2)

9. Calculate the total momentum:

   9.1 Before the explosion (3)

   9.2 After the explosion (4)

10. Was the total (linear) momentum conserved in this experiment? (1)

11. Give a reason for the answer to QUESTION 10. (1)

**[45]**

**EXPERIMENT 2**

**1. TITLE: HOOKE'S LAW**

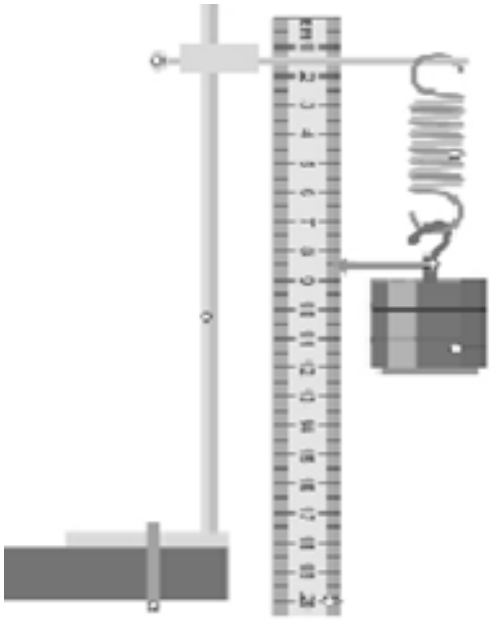
**2. AIM:** To determine the spring constant for a spring using Hooke's law

**3. APPARATUS/EQUIPMENT**

- Spring
- Boss and a clamp
- Pointer/Set square
- Mass hanger
- Ruler/Meter stick
- Mass pieces
- Slotted base
- Retort stand

**4. PROCEDURE**

- Set up the apparatus as shown in the diagram below.



- Attach the mass hanger's hook and pointer to the lower end of the spring. The pointer should just touch the ruler.

- Add a 20 g mass piece to the hanger, five to seven additions.

- Read the new position of the pointer in the ruler and record your results in the table on the next page.

- Repeat the procedure by adding more 20 g masses in steps and record the new stretched length each time by reading the position of the pointer on the ruler. Subtract the original length from the new length to calculate EACH extension.

**WORKSHEET FOR DETERMINING THE SPRING CONSTANT USING HOOKE'S LAW**

1. **PRACTICAL SKILLS**

| CRITERIA | MARKS |
|---|---|
| Correct setting up of apparatus:<br>• All apparatus were correctly set up. | 1 |
| Measuring skills:<br>• The ruler is placed vertically and in line with the retort stand.<br>• Does the learner correctly read the extension of the spring from the ruler?<br>• Does the learner allow mass pieces to come to a rest before readings are taken? | 3 |
| Safety precautions followed:<br>• Safety goggles are worn throughout the experiment.<br>• The retort stand is secured to the bench with a clamp to prevent it from falling over and hurting someone.<br>• Barrier in place to prevent feet. | 3 |
| **TOTAL** | **7** |

2. **TABLE OF RESULTS**

| MASS PIECE (g) | MASS IN kg | FORCE APPLIED (N) | ORIGINAL SPRING LENGTH (cm) | NEW SPRING LENGTH (cm) | EXTENSION OF THE SPRING (cm) | EXTENSION OF THE SPRING (m) |
|---|---|---|---|---|---|---|
| 20 | | | | | | |
| 40 | | | | | | |
| 60 | | | | | | |
| 80 | | | | | | |
| 100 | | | | | | |
| 120 | | | | | | |
| 140 | | | | | | |
| 160 | | | | | | |

(7)

3. For this investigation, write down the following:

   3.1 Dependent variable (1)

   3.2 Independent variable (1)

   3.3 Controlled variable (1)

4. Use the attached graph paper to draw a graph of the FORCE versus the EXTENSION OF THE SPRING in cm and also draw a best fit line. (6)

5. Use the graph to answer the following questions:

5.1 Calculate the gradient of the graph using any TWO of the first three points (of the graph). (3)

5.2 What does the gradient, calculated in QUESTION 5.1, represent? (1)

5.3 Determine the limit of proportionality of the spring. (2)

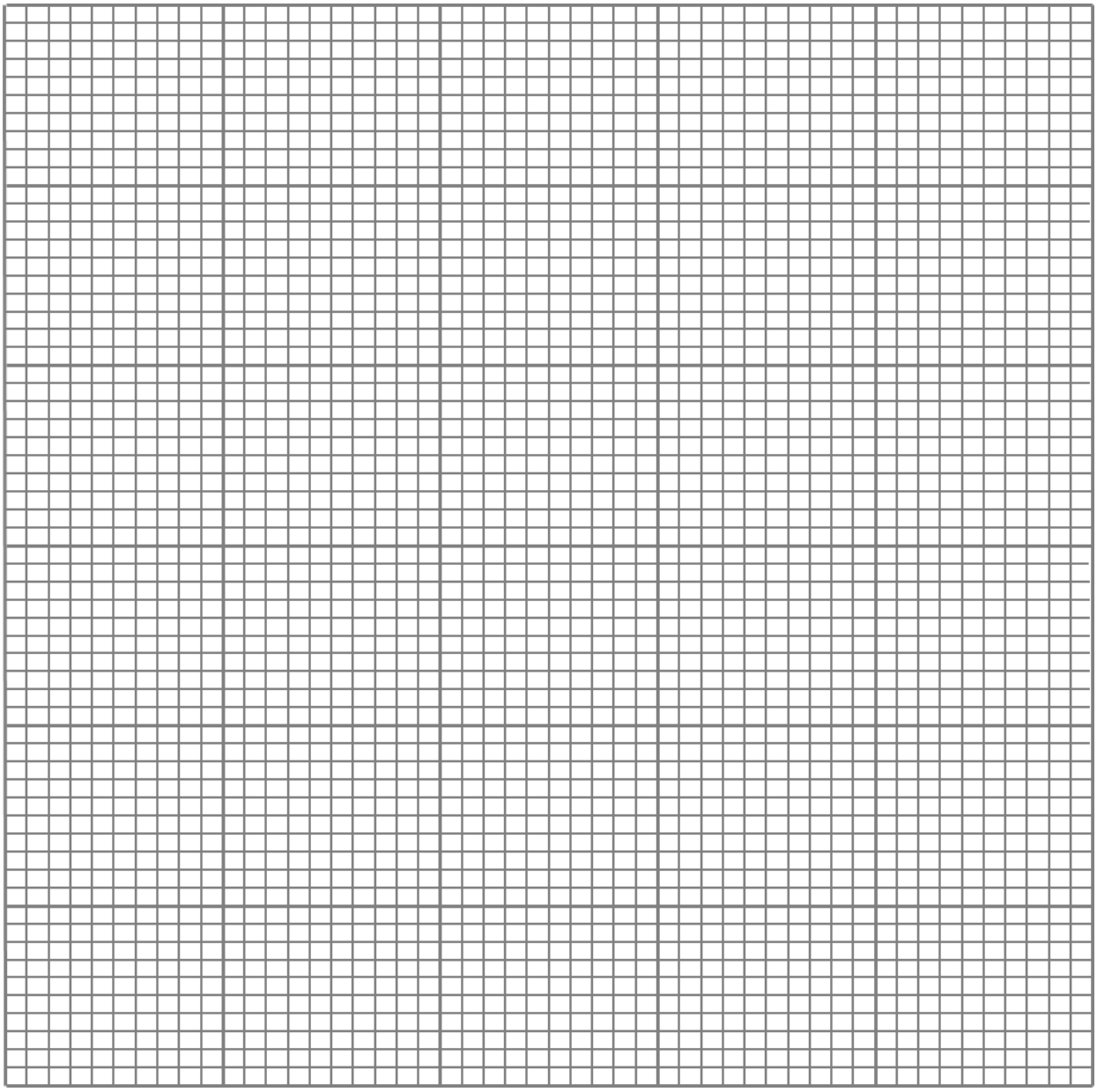
5.4 What change can be observed about the relationship between the applied force and the spring extension beyond the limit of proportionality? (2)

5.5 What conclusion can be drawn about the relationship between the applied force and the spring extension? (2)

6. State Hooke's law in words. (2)

**[35]**

**Graph paper for QUESTION 4**



**EXPERIMENT 3**

**1. TITLE: ELECTROLYTIC CELL**

**2. AIM:** To decompose copper(II) chloride ($CuC\ell_2$) solution through electrolysis

**3. APPARATUS/EQUIPMENT**

- Two copper rods
- Power supply
- Glass beaker
- Connecting wires
- Wire brush/Sand paper/Steel wool
- 1 $mol.dm^{-3}$ copper(II) chloride solution

**4. PROCEDURE**

- Pour 1 $mol.dm^{-3}$ copper(II) chloride solution into a beaker.
- Clean the copper rods using wire brush/sand paper/steel wool.
- Ensure that the power source is switched off.
- Connect one copper rod to the negative terminal of the power source and another copper rod to the positive terminal using connecting wires.
- Place the copper rods in the copper(II) chloride solution.
- Secure the electrodes firmly and ensure that they do not touch each other.
- Switch on the power source.
- Write down observations.
- Switch off the power source.

**WORKSHEET FOR THE ELECTROLYTIC CELL**

1. **PRACTICAL SKILLS**

| CRITERIA | MARKS |
|---|---|
| Wearing of appropriate protective clothing, e.g. coat, goggles, rubber gloves | 1 |
| Safety precautions followed:<br>• Prevent skin or eye contact with the copper(II) chloride solution.<br>• Power source initially switched off and immediately after completing the experiment.<br>• Ensure that the room is well ventilated or work in a fume cupboard. | 3 |
| Correct and safe handling of glassware (no breakage) and chemicals (no spillage/ swallowing) | 1 |
| Ensuring that electrodes were cleaned with steel wool/wire brush/sand paper | 1 |
| Correct assembling and handling of apparatus:<br>• Electrodes dipped into an electrolyte<br>• Electrodes not touching each other<br>• Electrodes correctly connected to the power supply | 3 |
| **TOTAL** | **9** |

2. Draw a labelled cell diagram to indicate how the apparatus will be assembled. (3)

3. Write down your observations made at the following electrodes:

   3.1 Positive (2)

   3.2 Negative (2)

4. Explain the observation made at the positive electrode (anode). (2)

5. Identify the product(s) formed at the following electrodes:

   5.1 Anode (1)

   5.2 Cathode (1)

6. Write down the following:

   6.1 Oxidation half-reaction (2)

   6.2 Reduction half-reaction (2)

   6.3 Net balanced ionic cell reaction (3)

7. Is the reaction in the cell EXOTHERMIC or ENDOTHERMIC?
   Explain. (3)

**[30]**