TEACHERS WITHOUT BORDERS PROGRAMME

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GRADE 10 EXAMINATION
June 2019

PHYSICAL SCIENCES

TIME: 2 hours + 10 minutes reading time	130 marks

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of
    - A question paper of 11 pages.
    - An insert of data and formulae

    Remove the pages of data and formulae. Make sure that your question paper is complete.

2. Read the questions carefully.

3. It is in your own interest to write legibly and set your work out neatly.

4. Use the booklet of data and formulae whenever necessary.

5. **All** questions must be answered.

6. All working must be shown.

7. Units need not be used in the calculations. They MUST be shown in the answers, however.

8. Give all answers correct to 2 decimal places.

PLEASE TURN OVER

QUESTION 1: MULTIPLE CHOICE

1.1   Which of the following is a vector quantity?

A. The magnitude of acceleration due to gravity

B. Distance

C. Speed

D. Instantaneous acceleration

1.2 A runner runs 4 km south in 0,5 hours and 5 km east in 1,5 hours. What is his average speed?

A. 4,50 km.h^{-1}

B. 5,67 km.h^{-1}

C. 20,50 km.h^{-1}

D. 5,00 km.h^{-1}

Base your answers to the following questions on the speed-time graph below. The graph represents the motion of a cart.
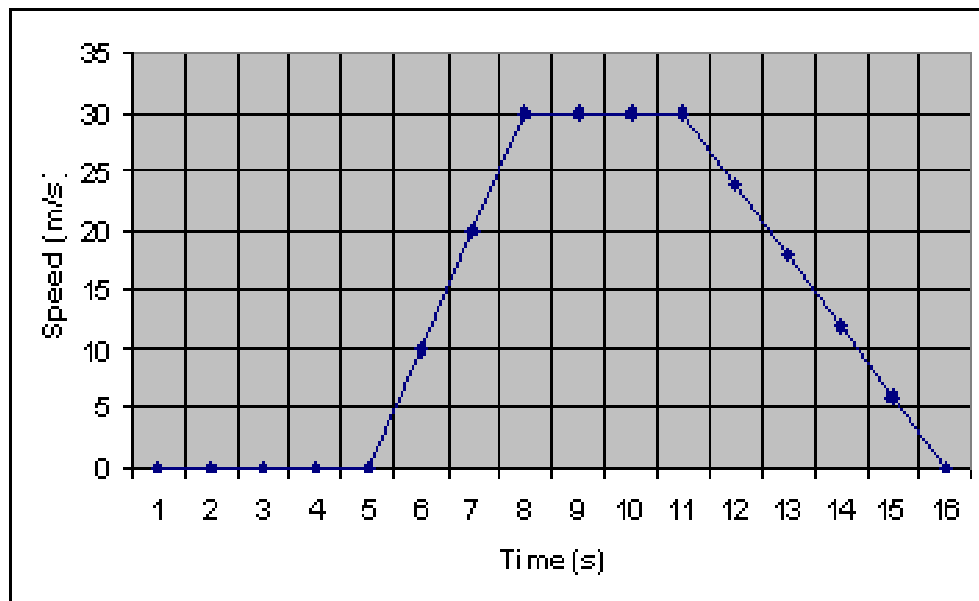
1.3   The cart travels the shortest distance in interval:

    A. 0-5 s
    B. 5-8 s
    C. 8-11 s
    D. 11-16 s

1.4   The cart's average speed is greatest during interval:
    A. 0-5 s
    B. 5-8 s
    C. 8-11 s
    D. 11-16 s

1.5   The magnitude of the cart's acceleration is greatest during interval:
    A. 0-5 s
    B. 5-8 s
    C. 8-11 s
    D. 11-16 s

1.6   During how many intervals is the cart's acceleration equal to zero?
    A. 1
    B. 2
    C. 3
    D. 4

1.7   The motion of two objects, A and B, are represented in the following displacement-time graph.
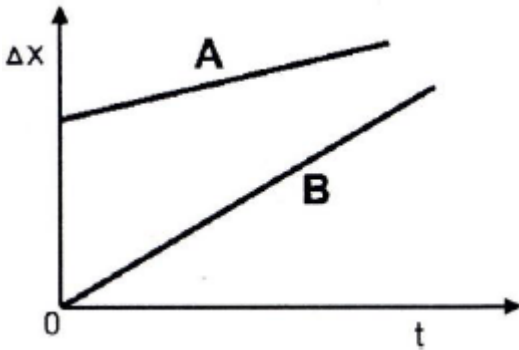
The graph indicates that:

    A.   B is moving faster than A.
    B.   A and B have different accelerations.
    C.   A and B are on a collision course.
    D.   A and B are moving in opposite directions.

1.8   The electronegativity of an atom indicates:

A. The tendency of the atom to attract itself a shared pair of electrons
B. The tendency of an atom to repel shared pairs of electrons
C. The ability the atom has to take electrons from another atom
D. The ability the atom has to form an ion

1.9   Which one of the following is a non-conductor of electricity in the solid phase but becomes a good conductor when molten?

A. ice
B. lead
C. graphite
D. sodium bromide

1.10   The gaseous substance which has polar covalent bonds between the atoms but the molecule as a whole is non-polar is:

A. O_2
B. CCl_4
C. HCl
D. NH_3

10 x 2 = [20]

QUESTION 2:

A girl throws a ball straight up into the air with a velocity of 15 m.s^{-1}.

2.1   What is the magnitude and direction of the acceleration of the ball?   (2)

2.2   Calculate the time it takes for the ball to reach the maximum height.   (4)

2.3   What is the maximum height that the ball reaches?   (4)

2.4   Calculate how high the ball will be, from the ground, after 2 s.   (4)

2.5   Draw a velocity-time sketch graph of the motion of the ball.   (3)

                                                                                                                                    [17]

QUESTION 3:

A car heads towards the dockyard. The car is travelling too fast, and the driver slams on

brakes and tries to stop before the car goes over the edge and falls into the water. The car is

moving at 33 m.s^{-1} when the   driver applies the brakes. The man's
          reaction time is 0,3s   and the

dock is 50 m long.

3.1   What is the car's speed in km.h^{-1}?   (1)

3.2   Define acceleration.   (2)

3.3   Calculate the distance the car travelled during the reaction time.   (2)

3.4   Determine the deceleration needed for the car to stop before going over the edge of the
          dock.   (5)

                                                                                                                                    [10]

QUESTION 4

The graph below shows the changing velocity of an object over a 10 s period. The object was initially moving in a Northerly direction for the first three seconds of the journey.
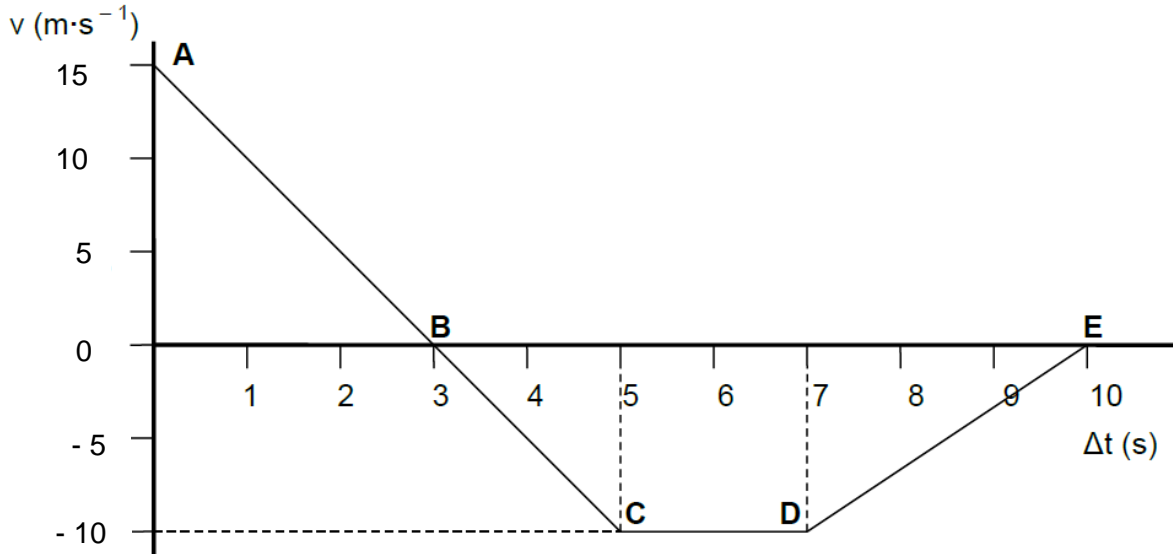
4.1   Describe the motion of the object from A to B. Include any relevant values in your description.   (5)

4.2   In which time period is the object moving at a constant velocity?   (1)

4.3   In which section of the graph is the object moving South?   (1)

4.4   Using the graph calculate the distance the object had travelled after five seconds.   (4)

4.5   Find the total displacement of the object after 5 seconds.   (2)

4.6   Use the graph to calculate the acceleration of the object over the first five seconds.   (5)

4.7   On the insert provided, draw a displacement-time graph to show the motion of the object over the 5 second time interval. Clearly indicate points A, B and C and show any relevant values on the y-axis.   (7)

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QUESTION 5

5.1   Explain the difference between valency and valence electrons.   (2)

5.2   Write down the electronic configuration of

     5.2.1   Lithium   (1)

     5.2.2 Ca^{2+} (2)

5.3   Draw:

     5.3.1   A Lewis dot diagram for an Oxygen atom.   (1)

     5.3.2   An Aufbau diagram for the Fluorine ion.   (2)

5.4   Sodium reacts with chlorine to form sodium chloride, a substance used in all households.

     Give:

     5.4.1   the household name of sodium chloride.   (1)

     5.4.2   the chemical formula of sodium chloride.   (1)

     5.4.3   Write a balanced chemical equation for the reaction of sodium and chlorine.   (4)

5.5   Solid carbon dioxide is known as dry ice. Under normal circumstances dry ice sublimates as it warms up.

     5.5.1   Explain the term 'sublimation'.   (2)

     5.5.2   Name the shape of the CO_2 molecule.   (1)

     5.5.3   Name the intermolecular force between CO_2 molecules.   (1)

     5.5.4   Name the specific intermolecular force experienced between the molecules of

            CO_2 dissolved in water.   (2)

5.6   When you take a block of butter out of the fridge, it is hard. However, after 15 minutes

     at room temperature it is soft enough to spread. Use the kinetic theory to explain the

     above observation.   (3)

                                                            [23]

QUESTION 6

6.1 The heating curve for a pure substance at atmospheric pressure is shown in the graph below.
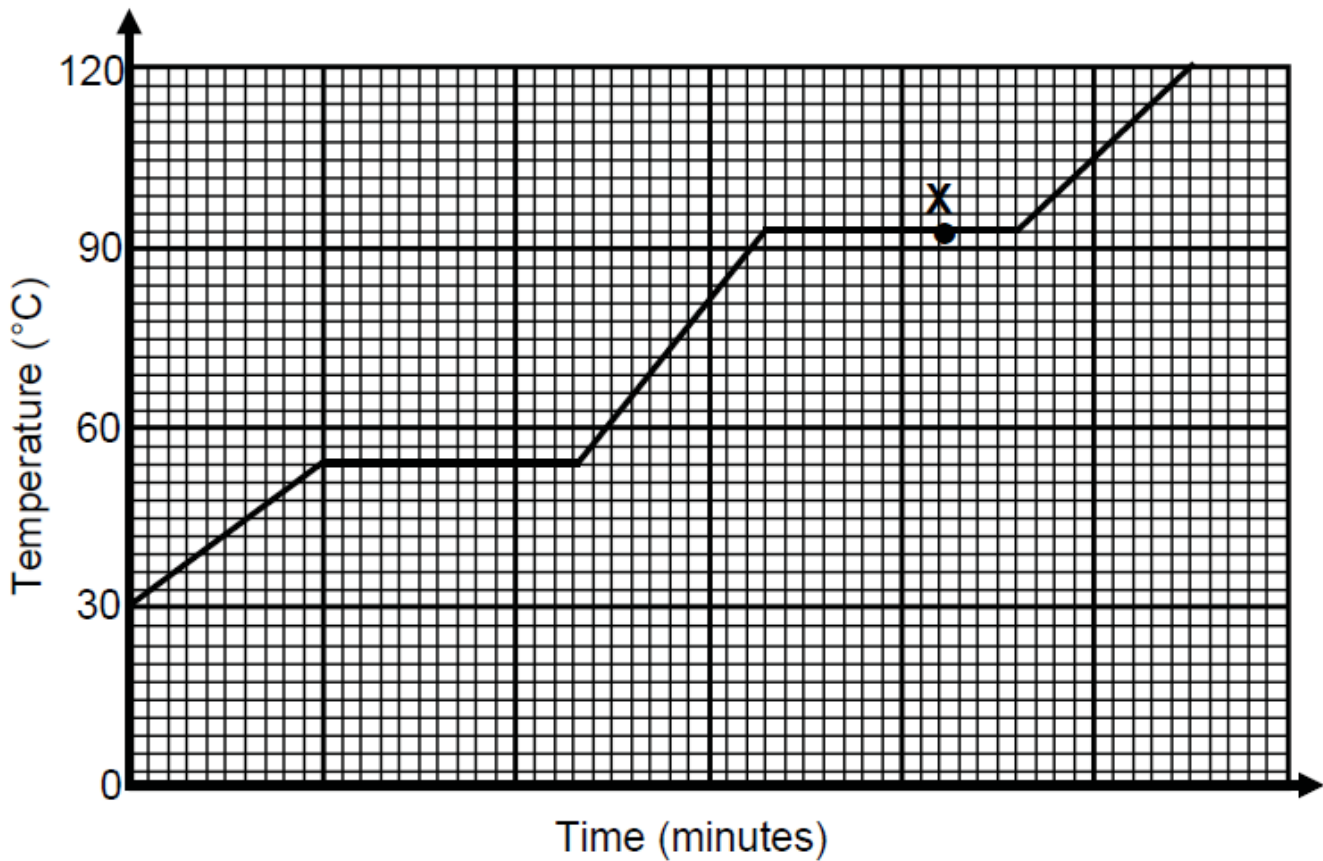
Use the information given in the graph and write down the following for this pure substance:

6.1.1 Melting point. (1)

6.1.2 Boiling point. (1)

6.1.3 Is this pure substance water? Give a reason for the answer: (2)

6.1.4 What is the physical state of the substance at:

    (a)   Point X shown on the graph. (1)

    (b) 30^0C (1)

6.1.5 What happens to the temperature while the substance melts? Explain this observation. (2)

6.2 The table below shows the melting and boiling points of different substances. Use the information in the table to answer the following questions.

Substance/Molecule	Melting point (^{0}C)	Boiling point (^{0}C)
CCl_4	-23	77
CH_4	-18	-162
He	-272	-269
NaCl	800	1413
NH_3	-77.73	-33.34
HCl	-114.9	-85.06

6.2.1 Which substance

    (a) has the weakest intermolecular forces? (1)

    (b) has hydrogen bonds between the molecules? (1)

    (c) requires the most energy to undergo phase change? (1)

    (d) is liquid at room temperature? (1)

6.2.2 Name the type of forces that exist between the particles of

    (a) CH_4 (1)

    (b) HCl (1)

    (c) NaCl (1)

    (d) He (1)

6.2.3 Choose one of the substances, from the table above, with a shape that is

    (a) Pyramidal (1)

    (b) Tetrahedral (1)

    (c) Linear (1)

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QUESTION 7

Information of six elements, represented as **P, Q, R, S, T** and **Y,** are given in the table below.

ELEMENT	ATOMIC NUMBER	MASS NUMBER	ELECTRON STRUCTURE
P	16	32	$1s^22s^22p^63s^23p^4$
Q	3	7	$1s^22s^1$
R	20	40	$1s^22s^22p^63s^23p^64s^2$
S	18	40	$1s^22s^22p^63s^23p^6$
T	17	37	$1s^22s^22p^63s^23p^5$
Y	19	39	$1s^22s^22p^63s^23p^64s^1$

7.1   Which element (**write only P, Q, R, S, T or Y**):

      7.1.1   Has 22 neutrons in each atom. (1)

      7.1.2   Is a noble gas. (1)

7.2   Two of the above elements are in the same group of the periodic table. Write down:

      7.2.1   The letters representing these two elements. (1)

      7.2.2   Their group number on the periodic table. (1)

7.3   ONE of the elements represented above is potassium. Write down the:

      7.3.1   Letter representing it. (1)

      7.3.2   The ion that it will form in a chemical bond. (1)

7.4   Identify element **S** (write the **name**), AND write down its ^A_ZX notation. (2)

7.5   Write down the FORMULA of the compound formed by the combination of elements:

      7.5.1   **Q** and **P**. (1)

      7.5.2   **R** and **T**. (1)

7.6 Another element, X occurs in nature as two isotopes, X-23 and X-25. The drawing shown below represents a sample of this element.

$\bigcirc$ = X-25

● = X-23

7.6.1 Explain the term "*isotope*". (2)

7.6.2 Use the above information and the diagram, to calculate the relative atomic mass of element **X**. (3)

7.6.3 Which isotope is the most abundant X-25 or X-23? (1)

[16]