

<b>Candidate Forename</b>		<b>Candidate Surname</b>	
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<b>Centre Number</b>						<b>Candidate Number</b>				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A215/02**

**TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL SCIENCE A**

**Unit 1: Modules B4 C4 P4 (Higher Tier)**

**MONDAY 25 JANUARY 2010: Afternoon**

**DURATION: 40 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**Candidates answer on the Question Paper**

**A calculator may be used for this paper**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer ALL the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

## **INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 42.
- A list of physics equations is printed on pages 4 and 5.
- A copy of the Periodic Table is provided.

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# TWENTY FIRST CENTURY SCIENCE EQUATIONS

## USEFUL RELATIONSHIPS

### EXPLAINING MOTION

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

## ELECTRIC CIRCUITS

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

## THE WAVE MODEL OF RADIATION

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

**Answer ALL the questions.**

- 1 Tina investigates the effect of temperature on enzymes.  
She uses the enzyme catalase to break down hydrogen peroxide.  
She collects the oxygen gas given off by the reaction.  
Here are some of her results.**

<b>TEMPERATURE OF CATALASE AND HYDROGEN PEROXIDE IN °C</b>	<b>VOLUME OF GAS COLLECTED IN 1 MINUTE IN CM<sup>3</sup></b>
<b>20</b>	<b>18</b>
<b>30</b>	<b>36</b>
<b>40</b>	<b>40</b>
<b>90</b>	

- (a) Suggest how much gas she will collect at 90 °C.**

**answer \_\_\_\_\_ [1]**

- (b) Tina tries to use a different enzyme to break down hydrogen peroxide.**

**Use the lock and key model to explain why this will not work.**

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**[3]**

- (c) (i) Hydrogen peroxide molecules bind to a specific part of the enzyme.**

**Name this part.**

\_\_\_\_\_ **[1]**

- (ii) How can a change in pH stop an enzyme from working?**

**Put a tick (✓) in the box next to the correct answer.**

**The shape of the enzyme is changed.**

**The shape of the molecule binding with the enzyme is changed.**

**The number of collisions is increased.**

**The speed of the collisions is decreased.**

**[1]**

**[Total: 6]**

- 2 (a) Changes take place in the body when the concentration of blood plasma becomes too low.

Choose FIVE of the following statements to describe these changes and put them in the correct order.

The first one has been done for you.

- A Receptors in the hypothalamus detect LOW plasma concentration.
- B Plasma becomes less concentrated.
- C Plasma becomes more concentrated.
- D Less ADH is secreted by the pituitary.
- E More ADH is secreted by the pituitary.
- F Less urine is produced.
- G More urine is produced.
- H More water is filtered out from the kidneys.
- I Less water is filtered out from the kidneys.

A				
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[3]



**(b) The formation of urine is one way that the body loses water.**

**Give TWO other ways in which water is lost.**

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**[2]**

**[Total: 5]**

**3 Patrick is running in a race. This changes his core body temperature.**

**(a) Where in Patrick's body is the receptor that detects this change?**

Put a **ring** around the correct word in the list below.

**HYPOTHALAMUS**

**KIDNEY**

**LIVER**

**PITUITARY**

**THYROID**

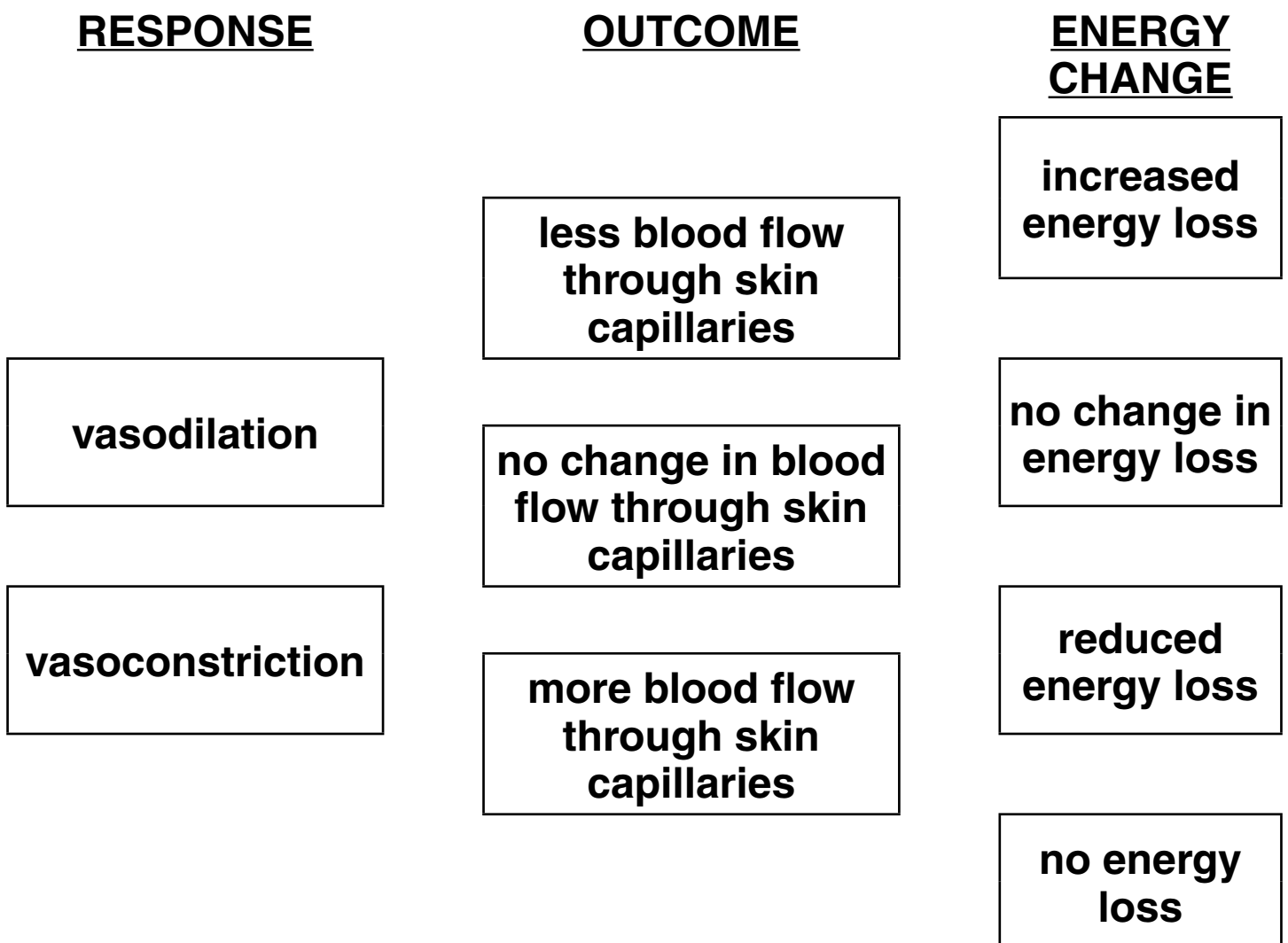
**[1]**

(b) Patrick's temperature control system involves changes to the blood vessels supplying his skin.

Draw straight lines to link each RESPONSE to the correct OUTCOME.

Draw straight lines to link each correct OUTCOME to the correct ENERGY CHANGE.

You should draw FOUR lines.



[2]

[Total: 3]

4 Atoms are made up of protons, neutrons and electrons.

(a) The charge and the mass of protons, neutrons and electrons are not the same.

Draw straight lines to join each type of PARTICLE to its CHARGE.

Draw straight lines to join each type of PARTICLE to its RELATIVE MASS.

<u>CHARGE</u>	<u>PARTICLE</u>	<u>RELATIVE MASS</u>
0	proton	almost zero
-1	neutron	1
+1	electron	

[2]

**(b) Many chemical changes involve ions.**

**Draw ONE line between the two boxes which BEST describe what an ion is.**

**A crystal  
lattice ...**

**... which has gained or  
lost electrons.**

**or**

**or**

**A group of  
atoms ...**

**... which has gained or  
lost protons.**

**or**

**or**

**An atom or a  
group of atoms ...**

**... which has gained or  
lost neutrons.**

**or**

**or**

**An atom ...**

**... which has moved from  
one group to another.**

**[2]**

(c) The table, opposite, gives some information about ions of different elements.

Fill in the ion symbols, including their charge.

(d) The table shows the electron arrangements of four elements.

<b>ELEMENT</b>	<b>ELECTRON ARRANGEMENT</b>
<b>A</b>	<b>2.8.1</b>
<b>B</b>	<b>2.8.4</b>
<b>C</b>	<b>2.8.7</b>
<b>D</b>	<b>2.8.8.1</b>

Which two elements have properties which are most similar?

elements \_\_\_\_\_ and \_\_\_\_\_ [1]

[Total: 6]

<b>ELEMENT SYMBOL</b>	<b>NUMBER OF PROTONS</b>	<b>NUMBER OF ELECTRONS IN THE ION</b>	<b>NUMBER OF NEUTRONS</b>	<b>SYMBOL FOR THE ION</b>
<b>Li</b>	<b>3</b>	<b>2</b>	<b>4</b>	
<b>S</b>	<b>16</b>	<b>18</b>	<b>16</b>	

**[1]**

5 Sodium is in group 1 of the Periodic Table.

(a) Sodium burns in chlorine gas to make sodium chloride.

Draw one line between TWO boxes to show what sodium chloride looks like.

green		solid
or		or
brown		liquid
or		or
purple		gas
or		
colourless		

[1]

(b) Sodium reacts with iodine to make sodium iodide. Sodium iodide dissolves in water. Describe what happens when it dissolves in water. Use ideas about ions and molecules in your answer.

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[2]



**(c) Sodium also reacts with water.**

**(i) Name the two products formed when sodium reacts with water.**

\_\_\_\_\_ [1]

**(ii) Write a balanced symbol equation for this reaction.**

\_\_\_\_\_ [3]

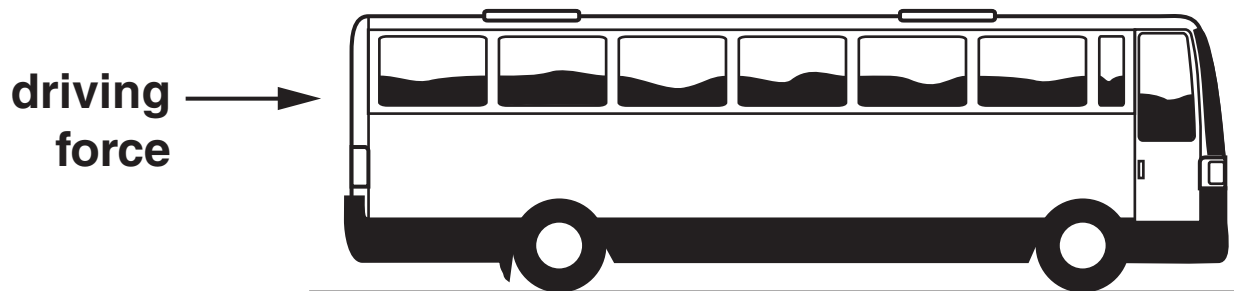
**(iii) A lump of sodium melts as it reacts with cold water.**

**Suggest why the sodium melts.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [1]

**[Total: 8]**

**6 Joe drives a bus along a level road.**



**(a) A driving force acts forwards on the bus when it is moving at a steady speed.**

**Explain why the driving force does not increase the speed of the bus.**

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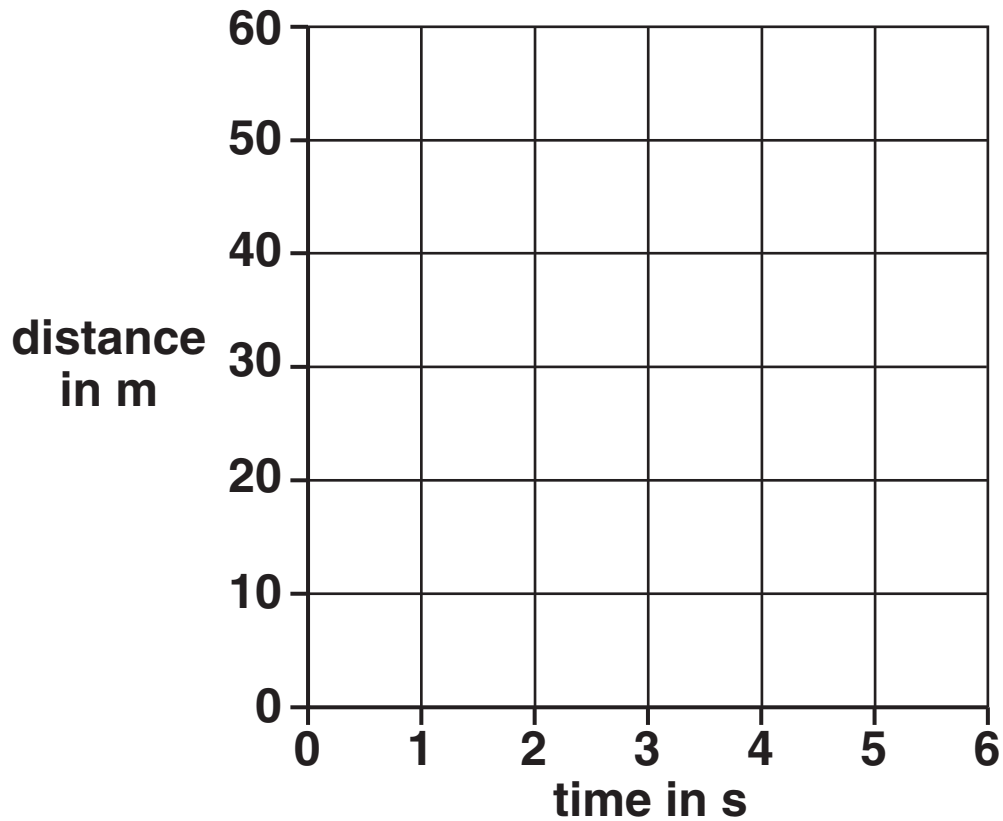
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**[2]**

(b) On the axes below, sketch a DISTANCE-TIME graph for the bus as it travels at a steady speed of 15 m/s.

Start the graph at the point 0,0.

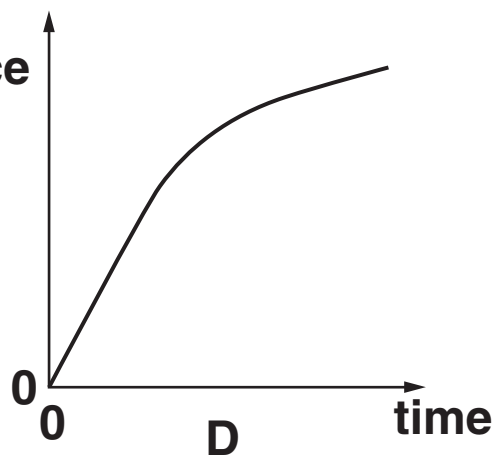
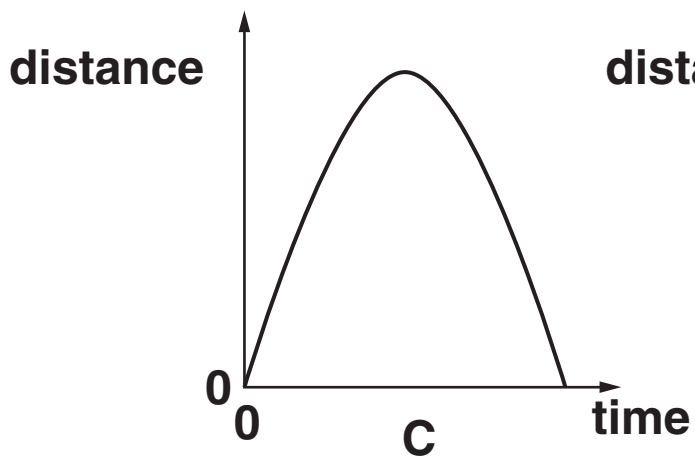
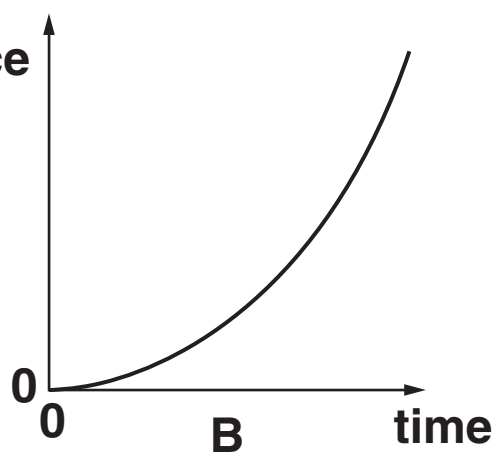
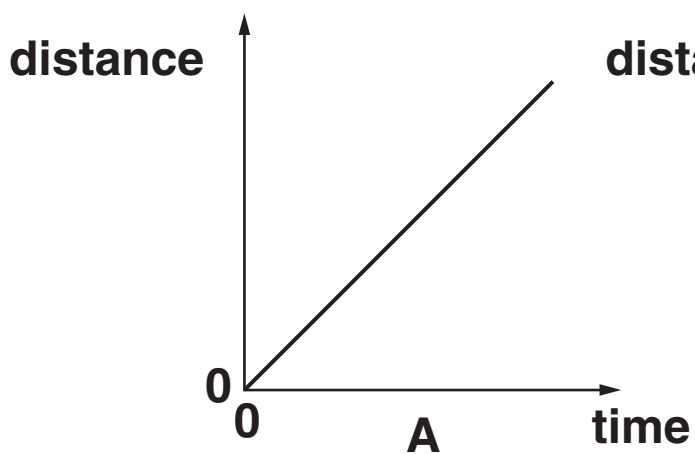


[2]

[Total: 4]

7 A small jet aircraft is speeding up along a runway.

(a) Which of these DISTANCE-TIME graphs, A, B, C or D, shows a steadily increasing speed?



answer \_\_\_\_\_ [1]

(b) The engines exert a force of 6000 N on the aircraft as it moves along the runway.

After 12 s it reaches its takeoff speed of 30 m/s from a standing start.

What is the momentum of the aircraft, in kg m/s, as it takes off?

Put a **ring** around the correct answer.

18 000

72 000

180 000

2 160 000

[1]

(c) The jet engine provides the driving force for the aircraft by pushing out hot gas.

Draw straight lines to link the START of EACH sentence to its correct END.

START

END

The gas is ...

... pushed forwards  
by the gas.

... pushed backwards  
by the gas.

... pushed forwards  
by the engines.

The engine is ...

... greater than the  
force on the gas.

... smaller than the  
force on the gas.

The force on the  
engine is ...

... pushed backwards  
by the engines.

... the same size as the  
force on the gas.

[2]

(d) As it moves along the runway the aircraft has an average speed of 15 m/s.

Why is this DIFFERENT from the takeoff speed of 30 m/s?

Put a tick (✓) in the box next to the correct reason.

The counter force of friction increases as the aircraft speeds up.

Average values are always less accurate than instantaneous ones.

The takeoff speed of the aircraft is always double the average speed.

The instantaneous speed of the aircraft changes as it moves along the runway.

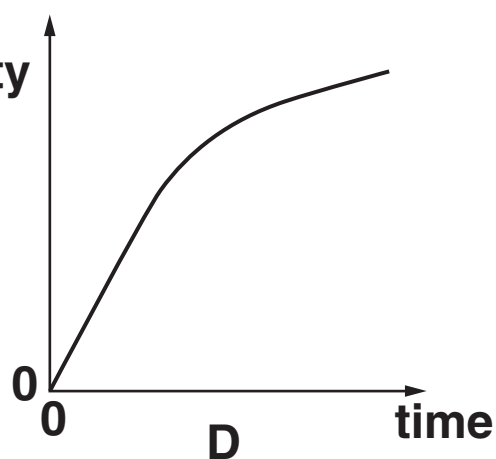
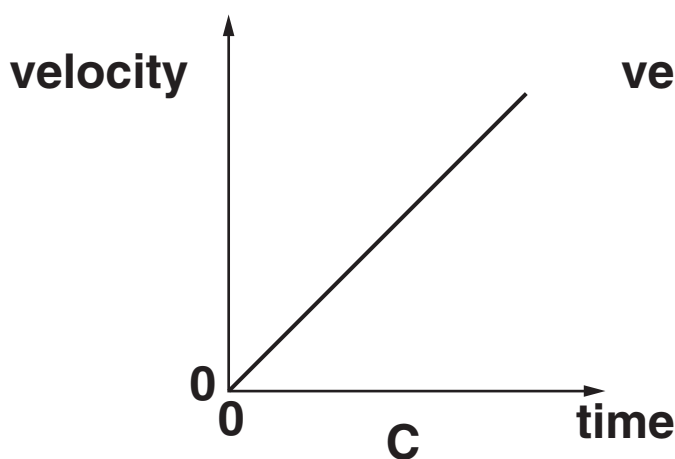
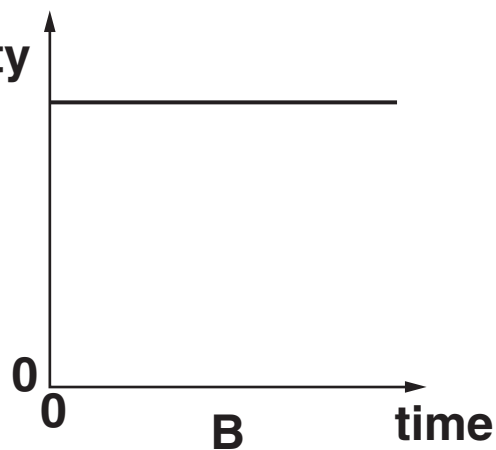
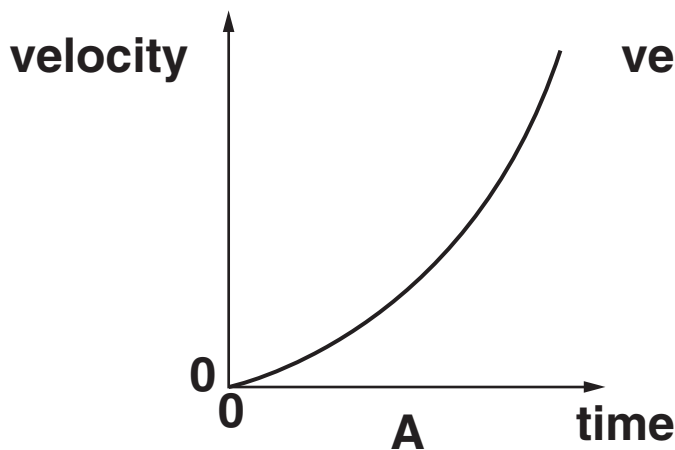
[1]

[Total: 5]

8 Jim takes part in a high jump contest.

(a) Jim runs up to the bar, increasing his velocity steadily from a standing start.

Which of these VELOCITY-TIME graphs, A, B, C or D, shows this?



answer \_\_\_\_\_ [1]



(b) Jim has a mass of 70 kg. Just before he jumps up, his velocity is 8 m/s.

Who has the correct value for his kinetic energy?

ALAN  
280 J

CARLOS  
2240 J

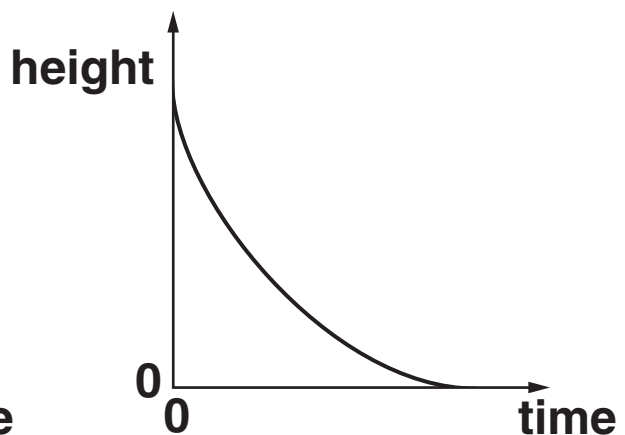
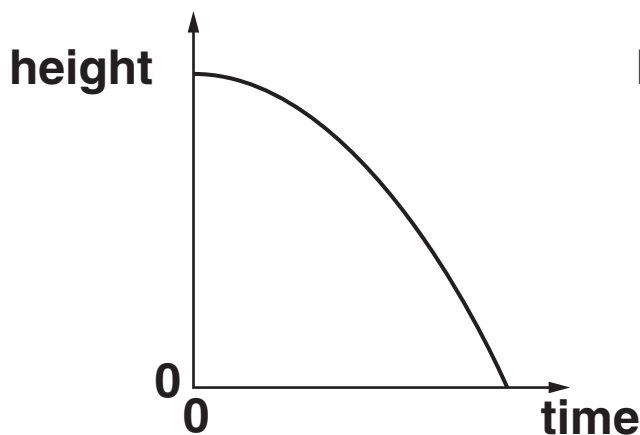
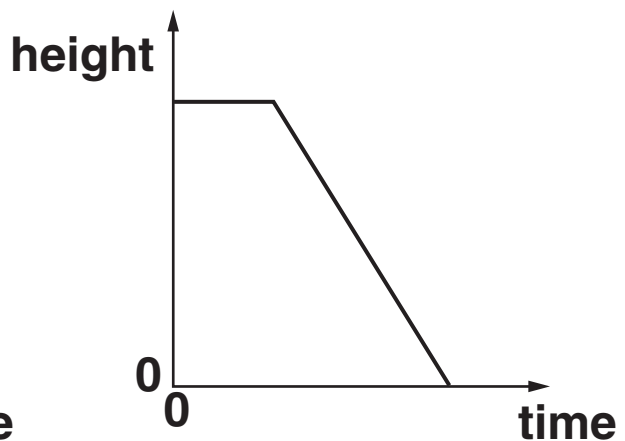
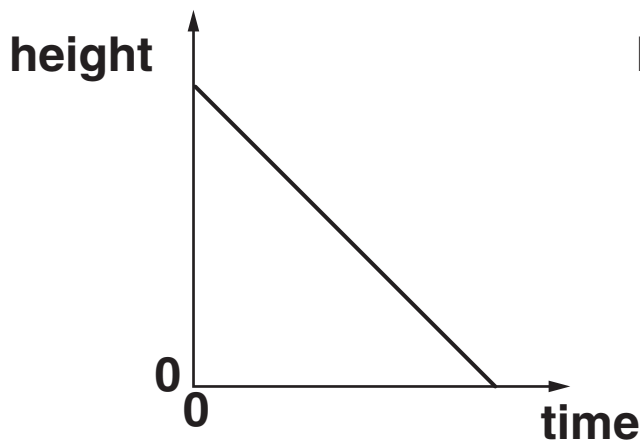
BESS  
560 J

DAVINA  
78 400 J

answer \_\_\_\_\_ [1]

(c) Jim clears the bar, then falls back to the ground.

Put a ring around the correct HEIGHT-TIME graph for Jim as he FALLS.



[1]

**(d) Jim comes to rest after he hits the crash mat.**

**Put ticks (✓) in the boxes next to the TWO correct statements.**

**Friction from the crash mat stops him falling over.**

**The reaction force from the crash mat reduces his momentum.**

**As he hits the crash mat, his kinetic energy is reduced through heating.**

**His weight decreases because the crash mat provides a reaction force.**

**His gravitational potential energy increases as he hits the crash mat.**

**[2]**

**[Total: 5]**

**END OF QUESTION PAPER**



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