Sydney Boys High School

Name:	
Class:	Teacher:

Year 10 Science

November 2023
Yearly Exam
Chemistry, Evolution

General Instructions

- Reading time: 5 minutes
- Working time: 60 minutes
- Write using black or blue pen
- Draw diagrams using pencil
- SHOW ALL WORKING
- Board approved calculators may be used
- Write your name, class and teachers name in the box provided

Total marks – 40

Part A – Multiple Choice
1 - 10 Knowledge
11 - 20 Process
- 20 marks

Part B – Free Response
- 20 marks

PART A – Multiple Choice Knowledge [10 Marks]

1 Which of the following statements is true regarding a precipitation reaction.

A. Both products must be soluble in water.

B. Spectator ions are always included in the reaction.

C. At least one of the reactants must be soluble in water.

D. At least one of the products will be insoluble in water.

2 A sudden major climatic change would most likely initially result in:

A. an increase in mutation rates.

B. a rapid increase in extinction rates.

C. a rapid increase in adaptive radiation.

D. a sharp increase in the numbers of species.

3 Choose the correct characteristic of a catalyst from the list provided.

A. A catalyst is always a solid.

B. A catalyst increases the rate of reaction.

C. A catalyst is consumed in a chemical reaction.

D. A catalyst decreases the heat produced by a reaction.

4 DDT is a chemical used to kill insects including mosquitoes. Twenty years after its first use, new mosquito types, which were not killed by DDT, appeared. This is a modern example of how:

A. an organism changes to suit its new environment.

B. a new substance in the environment can act as a selective pressure on a species.

C. a new substance in the environment can cause adaptations in a species.

D. evolution results from slow changes in species.

5 A fast reaction should:

A. be endothermic

B. be exothermic

C. have a low activation energy

D. have a high activation energy

6 A small amount of a powdered calcium carbonate is added to an excess amount of hydrochloric acid.

The volume of carbon dioxide produced is recorded every 20 seconds.

$$CaCO_{3[s]} + 2HCL_{[aq]} \rightarrow CO_{2[g]} + H_2O_{[l]} + CaCl_{2[aq]}$$

Time $[s]$	20	40	60	80	100	120	140	160	180
Vol CO_2 $[mL]$	40	70	88	101	110	116	120	120	120

Which row of the table below correctly identifies why the rate of reaction changes over time and why the reaction appears to stop after $140\ s$.

	Why the rate of reaction changes over time	*Why the reaction stops*
A.	fewer collisions between the reacting molecules occur	the calcium carbonate is used up
B.	fewer collisions between the reacting molecules occur	the hydrochloric acid is used up
C.	the energy of the reacting particles decreases over time	the calcium carbonate is used up
D.	the energy of the reacting particles decreases over time	the hydrochloric acid is used up

7 The fins of fish and whales are examples of structures that resemble each other and have similar function, but are the result of convergent evolution in separate lineages. These structures are called:

A. analogous structures.

B. embryonic structures.

C. homologous structures.

D. vestigial structures.

8 Which of the following is NOT a component of Darwin's Theory of Evolution?

A. Variation among species

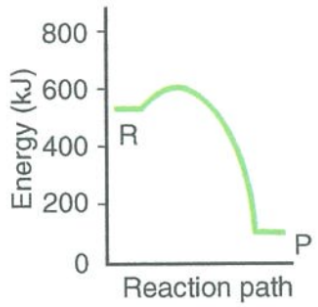
B. Survival and reproduction

C. Competition for food and space

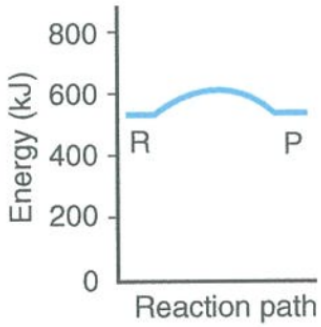
D. Inheritance of acquired characteristics

9 The following diagrams show energy paths for four different chemical reactions. Identify the one that would release the most energy.

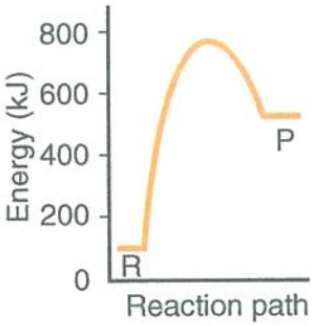
A.



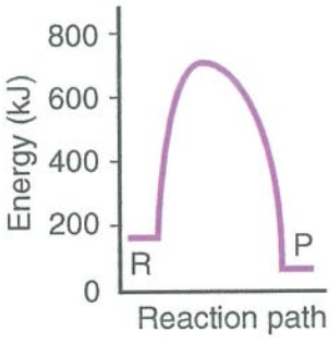
B.



C.



D.



10 Which most increases the chances of long-term survival for a species?

A. Different genes from all other species.

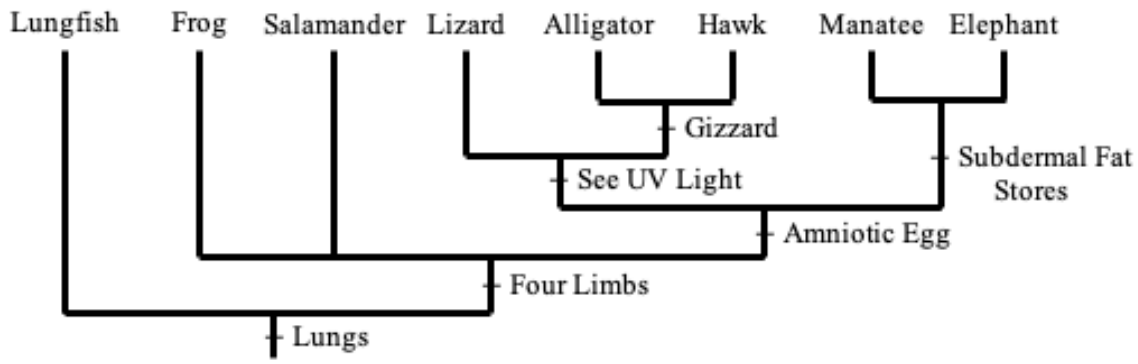
B. Genetic variations between individuals within the species.

C. Isolation from weaker species so that only the strongest individuals survive.

D. Changing environmental conditions so that the species can adapt to changes.

Multiple Choice Process [10 marks]

11



The cladogram above shows proposed phylogenetic relationships for several vertebrates. Selected derived traits are indicted on the cladogram by numbered labels. Based on the information presented, which of the derived traits is shared by alligators and manatees but not salamanders?

A. Amniotic Egg

B. Four Limbs

C. Gizzard

D. See UV Light

12 The energy released when some fuels are burnt is shown in the table below.

Name of fuel	*Formula*	*Amount of fuel burnt [g]*	*Energy released [kJ]*
Hydrogen	H_2	2	285
Carbon	C	12	393
Methane	CH_4	16	890
Ethanol	C_2H_6O	46	1360
octane	H_8H_{18}	114	5460

The fuel which released most energy per gram is

A. ethanol.

B. hydrogen.

C. methane.

D. octane.

For questions 13 and 14 use the table below.

The protein clock theory is based on a comparison of proteins in different organisms. It suggests that the number of differences in amino acid sequences in a protein that two organisms have in common is proportional to the length of time since the two organisms began evolving separately from a common ancestor.

The sequence of amino acids in the protein cytochrome C has been determined for a variety of organisms. The table shows the number of differences in cytochrome C between some organisms.

	human	monkey	sheep	rabbit	kangaroo	turtle	moth
human	0						
monkey	1	0					
sheep	10	9	0				
rabbit	9	8	4	0			
kangaroo	10	11	6	6	0		
turtle	15	14	9	9	11	0	
moth	31	30	27	26	28	28	0

13 The animal with cytochrome C most **unlike** that of humans is the

A. Monkey

B. Moth

C. Turtle

D. Sheep

14 Using the information in the table, which of the following animals are the most closely related?

A. rabbit and monkey

B. sheep and turtle

C. human and kangaroo

D. kangaroo and turtle

15 The Ediacaran fossils are one of the most significant fossil finds in Australia. They are fossils of soft-bodied sea creatures that were the first multi-cellular animals to live on Earth. Some these are part of the Ediacaran fauna and are 560 million years old. Living things did not invade the land until about 420 million years ago.

Event	Millions of years ago
First humans (genus *Homo*)	2
First flowering plants	130
First birds	150
First mammals	220
First dinosaurs	225
First reptiles	325
First amphibians	360
First ferns	410
First plants (moss) and animals on land	420
First animals with hard parts	545
First cyanobacteria	3800

The first appearance of the Ediacaran fossils is between the first appearances of

A. mosses and ferns.

B. ferns and amphibians.

C. cyanobacteria and animals with hard parts.

D. flowering plants and animals with hard parts.

16 The table shows the classification of some snakes.

Snake / Classification	Amethystine python	Common brown snake (venomous)	Diamond python	Red-bellied black snake (venomous)
Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata
Class	Reptilia	Reptilia	Reptilia	Reptilia
Subclass	Lepidosauria	Lepidosauria	Lepidosauria	Lepidosauria
Order	Squamata	Squamata	Squamata	Squamata
Suborder	Serpentes	Serpentes	Serpentes	Serpentes
Family	Boidae	Elapidae	Boidae	Elapidae
Subfamily	Booidea	Elapinae	Booidea	Elapinae
Tribe	Pythoninae	Elapinae	Pythoninae	Elapinae
Genus	*Morelia*	*Pseudonaja*	*Morelia*	*Pseudechis*
Species epithet	*amethistina*	*textilis*	*spilota*	*porphyriacus*

What is the highest classification in this table where venomous snakes are in the same group as each other but in a different classification from non-venomous snakes?

A. order

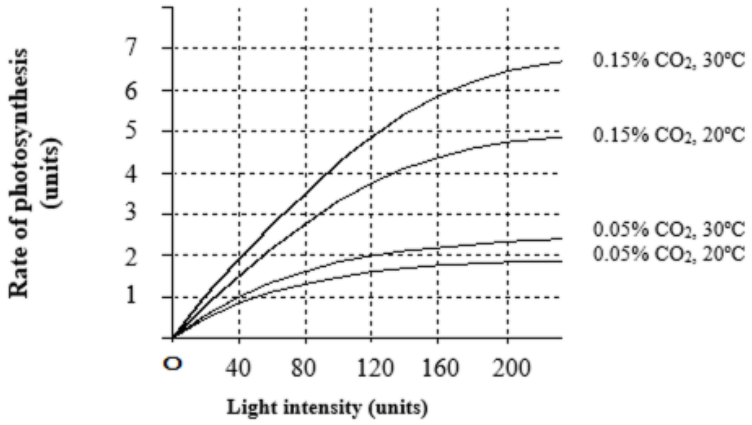
B. family

C. genus

D. species

For questions 17 and 18 use the table below.

The graph shows some information about the rate of photosynthesis in a plant species, under different conditions.



17 What is the rate of photosynthesis when carbon dioxide concentration is 0.15%, air temperature is 30°C and light intensity is 120 units?

A. 2.0 units

B. 3.8 units

C. 4.9 units

D. 6.6 units

18 Which conclusion can be drawn from this data?

A. Rate of photosynthesis is affected most by temperature.

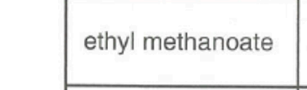
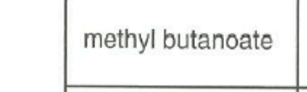
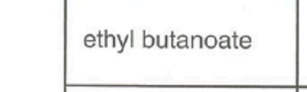
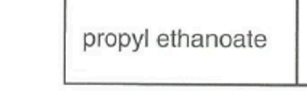
B. Rate of photosynthesis is directly proportional to light intensity.

C. Rate of photosynthesis is affected by the light intensity range tested.

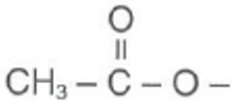
D. Light intensity is affected by rate of photosynthesis and temperature

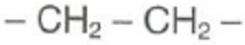
19 Many fragrances contain a group of compounds called esters.

The table gives information about some esters and the fragrance they produce.

Ester	Structural formula	Fragrance
ethyl methanoate		rum
methyl butanoate		apple
ethyl butanoate		pineapple
propyl ethanoate		pear

What structure do the ester compounds in the table have in common?

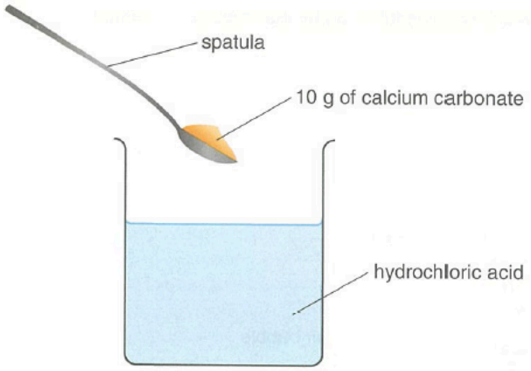
A. 

B. 

C. 

D. 

20 A student added calcium carbonate to hydrochloric acid as shown.



Calcium carbonate reacts with hydrochloric acid according to the following equation:

$$CaCO_{3\,[s]} + 2HCl_{[aq]} \rightarrow CaCl_{2\,[aq]} + H_2O_{[l]} + CO_{2\,[g]}$$

The student carefully weighed the beaker and the solution and the calcium carbonate before mixing them and then weighed the beaker with the contents after the reaction had finished.

How did the mass of the beaker and contents after the experiment compare to the total mass before the student carried out the experiment? Why?

A. Cannot be predicted without the atomic weights.

B. Less, because carbon dioxide gas escaped from the beaker.

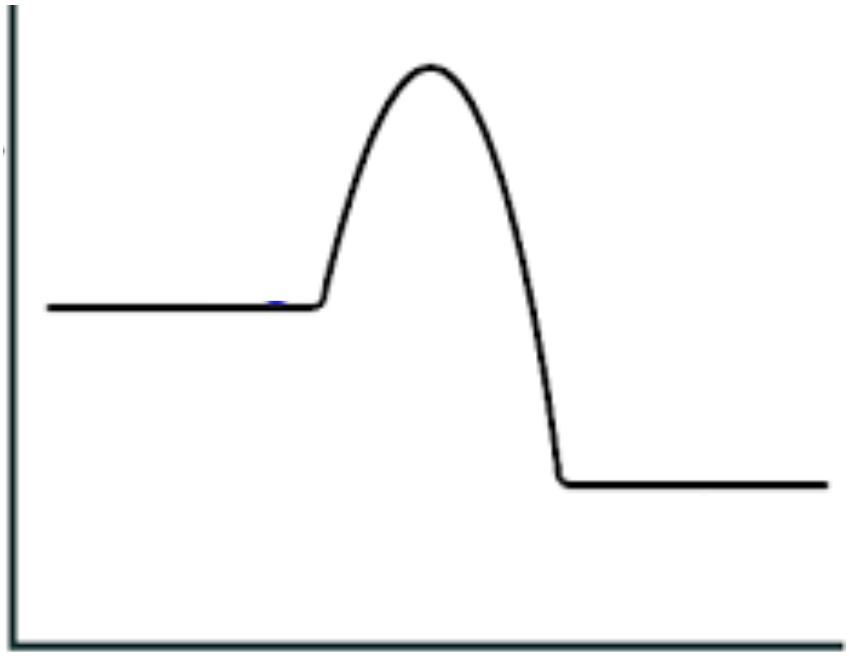
C. Greater, because calcium chloride is heavier than calcium carbonate.

D. Equal, because there are equal numbers of atoms on each side of the equation.

PART B – Extended Response Skills [20 Marks]

Question 21 [3 marks]

The energy profile for a given reaction is provided below.



(a) Label the energy profile shown with the following: **1**

activation energy, change in energy, energy, products, reactants, time

(b) Identify this reaction as endothermic or exothermic. **1**

……

(c) Show on the diagram what would happen if a catalyst were added to the reaction. **1**

Question 22 [7 marks]

A solution containing $0.36\ mol$ of lead (II) nitrate is mixed with a solution containing potassium iodide to produce a precipitate of lead (II) iodide.

(a) Write a full balanced chemical equation for this reaction. **1**

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(b) How many moles of potassium iodide are needed to ensure that all of the lead is reacted? **1**

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(c) What mass of lead (II) iodide is formed? **2**

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Question 22 continues on the next page

(d) Explain, referencing collision theory, how heating up the reaction mixture would increase the rate of this reaction. **2**

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(e) Identify one other way to increase the rate of this reaction. **1**

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Question 23 [4 marks]

Outline one piece of evidence that supports Darwin's Theory of Evolution by Natural Selection ensuring to detail how it supports the theory. **4**

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Question 24 [6 marks]

There are two types of peppered moths: a light and a dark form. Over the past 160 years, dramatic changes have been seen in the populations of peppered moths in England. During the 19th century, coal burning factories produced a lot of pollution in the form of soot. The soot blackened the bark of trees. Scientists noticed that populations of the peppered moths were changing from mostly light-coloured moths to mostly dark coloured moths. **6**



Two variations of peppered moths exist. A darker form and a lighter form.

Predict what may happen to the moth population if the air became cleaner and explain the process that has led to the changes in the moth population.

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END OF EXAM

Sydney Boys High School

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Year 10 Science ANSWERS

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Part A – Multiple Choice
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Part B – Free Response
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PART A – Multiple Choice Knowledge [10 Marks]

1 Which of the following statements is true regarding a precipitation reaction.

A. Both products must be soluble in water.

B. Spectator ions are always included in the reaction.

C. At least one of the reactants must be soluble in water.

D. At least one of the products will be insoluble in water.

2 A sudden major climatic change would most likely initially result in:

A. an increase in mutation rates.

B. a rapid increase in extinction rates.

C. a rapid increase in adaptive radiation.

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3 Choose the correct characteristic of a catalyst from the list provided.

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B. embryonic structures.

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8 Which of the following is NOT a component of Darwin's Theory of Evolution?

A. Variation among species

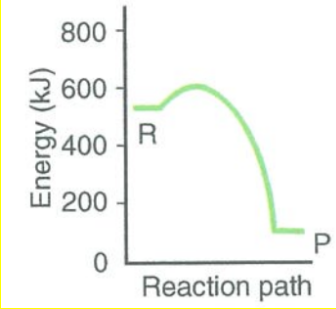
B. Survival and reproduction

C. Competition for food and space

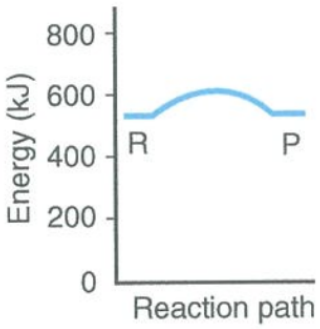
D. Inheritance of acquired characteristics

9 The following diagrams show energy paths for four different chemical reactions. Identify the one that would release the most energy.

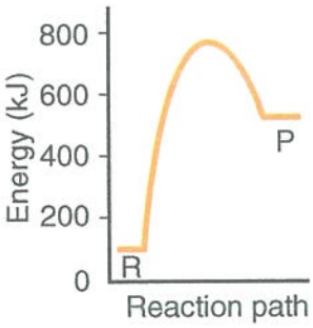
A.



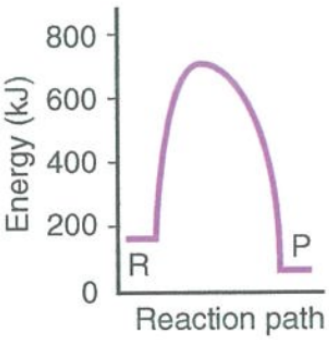
B.



C.



D.



10 Which most increases the chances of long-term survival for a species?

A. Different genes from all other species.

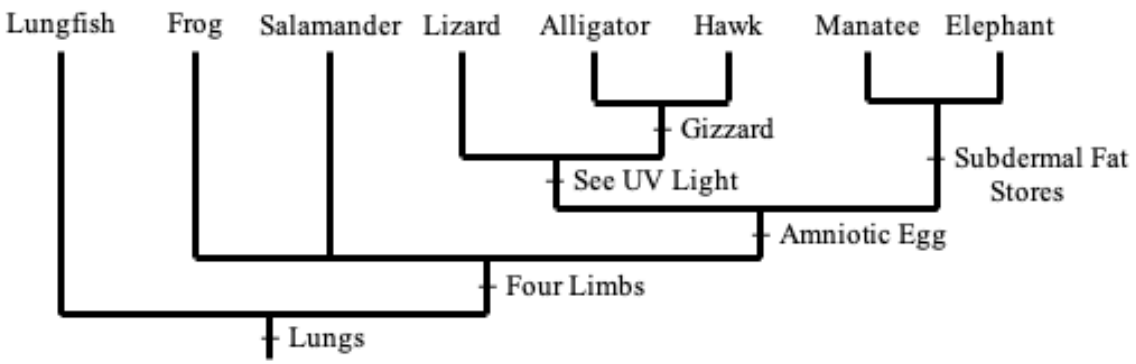
B. Genetic variations between individuals within the species.

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Multiple Choice Process [10 marks]

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The cladogram above shows proposed phylogenetic relationships for several vertebrates. Selected derived traits are indicted on the cladogram by numbered labels. Based on the information presented, which of the derived traits is shared by alligators and manatees but not salamanders?

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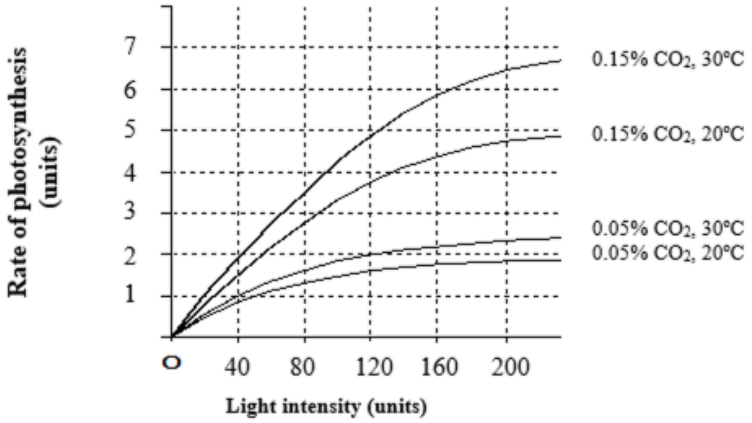
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18 Which conclusion can be drawn from this data?

A. Rate of photosynthesis is affected most by temperature.

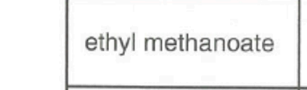
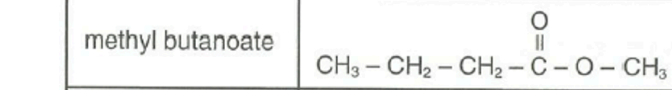
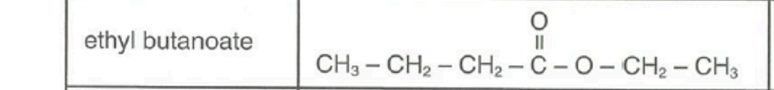
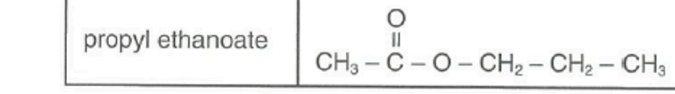
B. Rate of photosynthesis is directly proportional to light intensity.

C. Rate of photosynthesis is affected by the light intensity range tested.

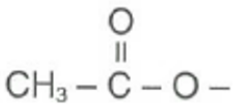
D. Light intensity is affected by rate of photosynthesis and temperature

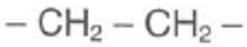
19 Many fragrances contain a group of compounds called esters.

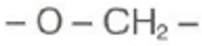
The table gives information about some esters and the fragrance they produce.

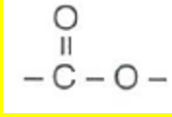
Ester	Structural formula	Fragrance
ethyl methanoate		rum
methyl butanoate		apple
ethyl butanoate		pineapple
propyl ethanoate		pear

What structure do the ester compounds in the table have in common?

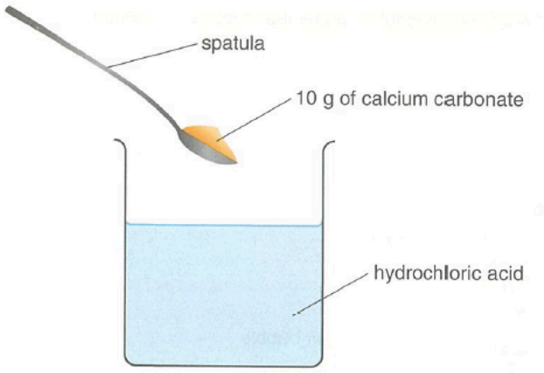
A. 

B. 

C. 

D. 

20 A student added calcium carbonate to hydrochloric acid as shown.



Calcium carbonate reacts with hydrochloric acid according to the following equation:

$$CaCO_{3\,[s]} + 2HCl_{[aq]} \rightarrow CaCl_{2\,[aq]} + H_2O_{[l]} + CO_{2\,[g]}$$

The student carefully weighed the beaker and the solution and the calcium carbonate before mixing them and then weighed the beaker with the contents after the reaction had finished.

How did the mass of the beaker and contents after the experiment compare to the total mass before the student carried out the experiment? Why?

A. Cannot be predicted without the atomic weights.

B. Less, because carbon dioxide gas escaped from the beaker.

C. Greater, because calcium chloride is heavier than calcium carbonate.

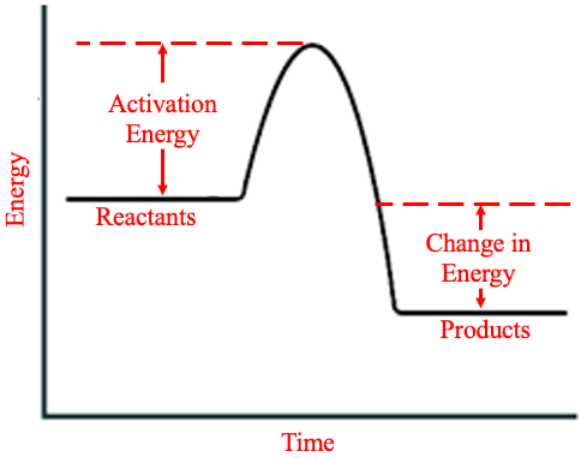
D. Equal, because there are equal numbers of atoms on each side of the equation.

Marking Guidelines

Question 21[a]

Criteria	Marks
▪ Applies ALL 6 labels correctly	1

Sample answer:



Question 21[b]

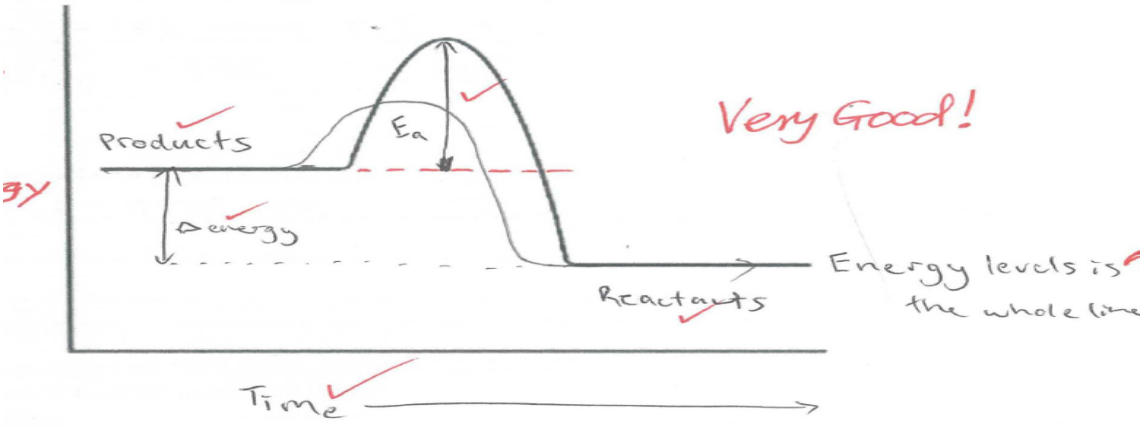
Criteria	Marks
▪ Identifies the reaction profile correctly as exothermic	1

Sample answer:
This reaction is exothermic.

Question 21[c]

Criteria	Marks
▪ Correctly shows a reaction pathway with a SMALLER activation energy. The energy of the reactants and product MUST remain unchanged.	1

Sample answer:



Question 22[a]

Criteria	Marks
▪ Provides a correct equation for the reaction, including correct states	1

Sample answer:

$$Pb(NO_3)_{2\,[aq]} + 2KI_{[aq]} \rightarrow PbI_{2\,[s]} + 2KNO_{3\,[aq]}$$

Answer could include:
Neutral species equation, full ionic equation or net ionic equation.

Question 22[b]

Criteria	Marks
▪ Correctly calculates the number of moles with full working out shown	1

Sample answer:
$n(Pb^{2+}) = n(PbNO_3) = 0.36\ mol$
$n(I^-) = n(KI)$

$$\frac{n(KI)}{n(Pb(NO_3)_2)} = \frac{2}{1} \rightarrow n(KI) = 2 \times n(Pb(NO_3)_2$$

$\therefore n(I^-) = 2 \times n(Pb^{2+}) = 2 \times 0.36$
$= 0.72\ mol$

Question 22[c]

Criteria	Marks
▪ Calculates the correct mass of lead (II) iodide showing full working	2
▪ Makes some progress towards the calculation of mass of lead (II) iodide.	1

Sample answer:
$n(PbI_2) = n(Pb(NO_3)_2) = 0.36\ mol$
$MM(PbI_2) = 207.2 + 2 \times 126.9 = 461\ g\ mol^{-1}$

$$n = \frac{m}{MM} \rightarrow m = n \times MM$$

$m(PbI_2) = n(PbI_2) \times MM(PbI_2)$
$= 0.36 \times 461$
$= 165.96\ g$

Question 22[d]

Criteria	Marks
▪ Explains that an increase in temperature leads to increased kinetic energy, resulting in an increase in number of particles having successful collisions above activation energy, thus increasing the reaction rate	2
▪ Identifies that increasing temperature increases the kinetic energy of the particles resulting in more collisions	1

Sample answer:
Increasing the temperature of the reaction mixture will increase the kinetic energy of the particles, so a higher proportion of collisions will exceed the activation energy, so the number of successful collisions increases. Thus, there is an increase in the number of successful collisions to form product, which results in an increased rate of reaction.

Note: Explanation MUST include activation energy, and must refer to 'successful collisions' not just more collisions. Answer should refer to 'proportion of particles ' or 'increased frequency' of successful collisiions.

Question 22[e]

Criteria	Marks
▪ Identifies one way of increasing the reaction rate.	1

Sample answer:
Could include:
Increase the concentration; stirring the reaction mixture; addition of a catalyst.

Notes:
1. Pressure/Volume changes only to gas reactions, not aqueous solution reactions.
2. **ONE OTHER** way so **NOT** Temperature.
3.

Question 23

Criteria	Marks
▪ Comprehensively outlines one piece of evidence and provides a thorough explanation of how it supports Darwin's Theory of Evolution by Natural Selection. Using specific examples	4
▪ Describes & explains how a piece of evidence supports Darwin's Theory of Evolution.	3
▪ Describes a piece of evidence that supports Darwin's Theory of Evolution.	2
▪ Identifies a valid piece of evidence that supports Darwin's Theory of Evolution by Natural Selection. OR Describes a piece of evidence that supports Darwin's Theory of Evolution (but implies characteristic is acquired)	1

Sample answer:
One piece of evidence that supports Darwin's Theory of Evolution by Natural Selection is the fossil record. Fossils are the preserved remains or traces of ancient organisms, and they provide a detailed snapshot of life's history on Earth. The fossil record helps support Darwin's theory in several ways. First, as fossils can be dated to millions of years ago, they indicate that life on Earth has been evolving over an immense timescale. Second, the fossil record reveals a series of transitional forms that link ancient organisms to their modern descendants. For example, the fossil record includes a remarkable series of fossils documenting the evolution of whales from land-dwelling ancestors. These transitional fossils show how over time, whales' ancestors adapted to aquatic environments, providing clear evidence of gradual change, which is a fundamental component of natural selection. Furthermore, the distribution of fossils in the geological layers reflects the principle of superposition, with more primitive organisms found in lower rock layers and more advanced ones in upper layers. This supports the idea that life has changed over time, with older species giving rise to newer ones through a process of descent with modification.

Answer could include, but not limited to:
Comparative Embryology
DNA
Analogous and Homologous structures
Biogeography

Question 24

	Identifiers/concepts	Sample student response
P 0	• restate the task	• The soot blackened the bark of the trees • The peppered moths were changing from mostly light coloured moths to mostly dark coloured moths
	• provide a meaningless or irrelevant response	• Don't know • a banana ily<3
U_1 1	• identify a predicted change in moth population	• I believe the population of moths have increased • Become extinct • The peppered moths will consist of both light colours and dark colours again just as they were before over a long period of time • they may have started to go back to there original colour and population a bit more even in colour
	• identify the change in the environment	• The level of black soot in the air has been reduced to almost zero • the amount of soot has dropped • the soot is affecting the tree which the peppered moths get their food • we are burning coal which sends of pollution which affects the moths habitat
	• identify a commonsense mechanism for the change in moth population	• The soot may have covered the moths, making them look like the darker form of moths. • the moths must have soaked in the soot to make them black • poisoned by soot • The moths evolved since they has to adapt to the black soot • they have become less vunerable to prey • the birds could see the moths when the tree were black so the birds ate the moths
M_1 2	• provide two or more U_1 responses	• The population of moths will increase due to the reduction of black soot in the air. | The moths would have become lighter in colour due to the reduction of black soot. • the rate of light coloured moths changing to dark coloured moths may have gone down due to cleaner air and the reduction of black soot in the air. • moths have evloved since the 1960's even more because the air has become cleaner and less soot. • they will be come white again because they need to adapt so they can hide from predators
R_1 3	• relate the change in environment to the change in moth population via a commonsense mechanism	• The population of moths would have declined as instead of being able to use their darkness to hide from predators with the cleaner air they would have been more easily seen • the population of the moths most likely would have been affedted by the pollution and therefore adapted and changed their colour to suit their environment | the moths may have evolved because of the air pollution and therefore evolved to black moths from their white moths ancestry • the moths colour changed because of the pollution in the air and the colour of trees | the pollution in the air made moths evolve from beeing white to black camouflague

	Identifiers/concepts	Sample student response
U_2 4	• identify the process as natural selection or survival of the fittest	• they would have gone through natural selection and the lighter coloured moths would be better off. the population of peppered moths would go back to mainly lighter ones because they were better suited to the environment they're in.
	• describe that the environmental change has determined the rate of survival	• the peppered moths had a pressure from the environment (the bark of the trees would have become lighter) and this pressure would have made the survival potential of the lighter peppered greater and therefore the majority of the population of the moths would become lighter.
	• identify that there is variation within a population or a favourable trait	• THe moths may have evolved by taking on an structural adaption - a characteristic that enables an organism to thrive or survive better in it's environment.
	• identify that some individuals survive to reproduce	• The dark coloured moths would stand out against the lighter bark of the tree, making them easier prey. light coloured moths would blend in better so therefore would be able to surive and reproduce.
	• identify that generations will increasingly show favourable traits	• The moths evolved by changing their colour slightly every generation. After many years, a dramatic difference is visable in the moths.
M_2 5	• provide two or more U_2 responses	• The black peppered mots physical appearance is dark so that they can camouflage against the coal factories which make them less easier to see and be seen as prey whereas the light peppered moths are easier to see and are more likely to become prey. this is an example of 'survival of the fittest' • The level of soot decreased and therefore the trees lightened up. It is now easier for the white form of peppered moths to camoflage | through natural selection the white moths were dieing out. However the remaining moths retained the white gene and were able to pass it on again when it became easier for white moths to survive. • natural selection would have enforced a change of white to black. Predators would have been able to detect white moths more easily, leaving only black moths to live and reproduce. | The moths may have evolved to produce offsprings with colours matching those of their environments in order to survie and be suitable for their environment.
R_2 6	• relate the change in moth population to individuals that survive an environmental change to reproduce and pass the advantageous **traits** to their **offspring**	• The population of moths may have changed back from mostly dark coloured moths to mostly light coloured moths. This is because of the mechanism of natural selection: such an adaptation (the lighter colour of the moths) would increase the chances of survival and reproduction of this organism because it would be better camouflaged from possible predators due to the change of its environment from a predominatly sooty colour to a more creamy colour. | As stated above, these moths may have evolved to become more light coloured. This would have happened throught the process of natural selection: as the moths' environment changed to a more creamy colour, light-coloured moths would have a better chance at survival due to camouflage from their possible predators. This would increase their chances of survival and reproduction and thus as generations passed more moths would inherit this characteristic of being light-coloured.

Scored and annotated student samples

Task 1.1 **P response**	restates the task by copying text from the task.

Predict what will happen to the population of moths if the air becomes cleaner.

The soot blackened the bark of trees.

Explain the process that has lead to the changes in the moth population.

coal burning factories produced a lot of pollution in the form of soot

Task 1.2 **P response**	provides a meaningless or irrelevant response.

Predict what will happen to the population of moths if the air becomes cleaner.

idk

Explain the process that has lead to the changes in the moth population.

idk

Task 1.3 **U_1 response**	identifies a prediction about the moth population

Predict what will happen to the population of moths if the air becomes cleaner.

I believe the population of moths have increased. It increased because the air has become cleaner.

Explain the process that has lead to the changes in the moth population.

Task 1.4 **U_1 response**	identifies a change in the environment

Predict what will happen to the population of moths if the air becomes cleaner.

There would be cleaner air.

Explain the process that has lead to the changes in the moth population.

the level of black soot in the air has been reduced to zero.

Task 1.5 **U_1 response**	identifies a commonsense mechanism for the change in moth population

Predict what will happen to the population of moths if the air becomes cleaner.

the moths must have socked in the soot to make them black

Explain the process that has lead to the changes in the moth population.

after the mum or dad sucks in the soot the baby moths must have some of the soot still.

Task 1.6 **M_1 response**	provides two or more U_1 responses: identifies a prediction about the moth population AND a change to the environment

Predict what will happen to the population of moths if the air becomes cleaner.

The population of Peppered moths would have more lighter colored moths and less darker colored moths if the air became cleaner.

Explain the process that has lead to the changes in the moth population.

The coal burning factories produced a lot of pollution into the air in the form of soot. The soot blackened the bark on trees where the moths live.

Task 1.7 **M_1 response**	provides two or more U_1 responses: identifies a prediction about the moth population AND a commonsense mechanism

Predict what will happen to the population of moths if the air becomes cleaner.

the population of peppered moths got reduced and there arent that many peppered moths left.

Explain the process that has lead to the changes in the moth population.

they could've evolved into normal moths

Task 1.8 **M_2 response**	provides two or more U_2 responses: identifies a change to the environment AND a commonsense mechanism for change

Predict what will happen to the population of moths if the air becomes cleaner.

the soot in the environment is affecting the moths.

Explain the process that has lead to the changes in the moth population.

They may have evolved in order to camouflage into this sooty environment

Task 1.9 **R_1 response**	relates the change in environment to the change in moth population via a commonsense mechanism

Predict what will happen to the population of moths if the air becomes cleaner.

The population of moths would have declined as instead of being able to use their darkness to hide from predators with the cleaner air they would have been more easily seen.

Explain the process that has lead to the changes in the moth population.

Moths have evolved to an almost completely population

Task 1.10 **R_1 response**	relates the change in environment to the change in moth population via a commonsense mechanism

Predict what will happen to the population of moths if the air becomes cleaner.

The population of moths will most likely start becoming lighter in colour, due to the reduction in black soot from coal burning factories in the air, the trees will no longer continually get black soot on them and turn darker which means the moths will not either.

Explain the process that has lead to the changes in the moth population.

Many different changes have occoured, the coal burning facoties created a black soot which blackened the bark of trees which meant the moths then turned that colour then they reduced the amount of black soot in the air to almost zero which meant the trees would not get any darker, neither will the moths. Over the past 160 years, peppered moths have evolved and two moths have been created, light and dark

Task 1.11 **U_2 response**	identifies the process as natural selection or survival of the fittest

Predict what will happen to the population of moths if the air becomes cleaner.

The population of light coloured peppered moths would increase.

Explain the process that has lead to the changes in the moth population.

This process is called natural selection. The light coloured moths are able to camouflage from prey unlike the the dark coloured moths which will be very visible to prey due to the lack of soot. This leads to the light coloured moths population to increase, unlike the dark coloured moths population which would decrease.

Task 1.12 **U_2 response**	identifies that there is variation within a population or a favourable trait

Predict what will happen to the population of moths if the air becomes cleaner.

the number of light moths have slowly increased

Explain the process that has lead to the changes in the moth population.

light moths are slowly spreading due to the level of black soot in the air that has been reduced. Their characteristic are more favourable for survival. Moths overall have evolved quite a bit, from light coloured moths dominating the environmnet, then dark coloured moths, then back to light coloured moths.

Task 1.13 **U_2 response**	identifies that some individuals survive to reproduce

Predict what will happen to the population of moths if the air becomes cleaner.

the colour of the peppered moths would slowly change back to light grey to adapt to the conditions

Explain the process that has lead to the changes in the moth population.

The light coloured moths would be left to reproduce and create more light coloured moths

Task 1.14 **U_2 response**	identifies that generations will increasingly show favourable traits

Predict what will happen to the population of moths if the air becomes cleaner.

due to the reuduction in the amount of pollution the light coloured moths will increase.

Explain the process that has lead to the changes in the moth population.

the moths' colour has evolved from the reduction in pollution with more light coloured moths with each generation, as shey should be, survive longer

Task 1.15 **M_2 response**	provides two or more U_2 responses: identifies the process as natural selection or survival of the fittest AND identifies that some individuals survive to reproduce

Predict what will happen to the population of moths if the air becomes cleaner.

the moths colours would become lighter as they would adapt to their environment.

Explain the process that has lead to the changes in the moth population.

natural selection is the theory of this process, as the environment changes animals need to adapt to survive in this case the lighter moths would have been see more easily by predators causing them to die out and the dark moths to survive and reproduce.

Task 1.16 **M_2 response**	provides two or more U_2 responses: describes that the environmental change has determined the rate of survival AND identifies that individuals survive to reproduce

Predict what will happen to the population of moths if the air becomes cleaner.

the population of the spotted moth would decline because they adapted the darker coloured barks and they would be hidden from any predators but if the air became cleaner then their predators would stop them easier. due to the lighter coloured bark, and not any bark covered by soot. the lighter coloured moths would have a higher survival rate and breed more causing more lighter moths.

Explain the process that has lead to the changes in the moth population.

the changes that led to the moths population is that there is hardly any more soot covering trees and the bark that the moths have adapted to. the air is cleaner and has less soot so there are less things for the spotted moth to hide on.

Task 1.17 **R_2 response**	relates the change in moth population to individuals who survive a change in the environment to reproduce and pass the trait to offspring

Predict what will happen to the population of moths if the air becomes cleaner.

The peppered moths had changed colour due to the change in air pollution. This pollution caused an increase in dark coloured moths, as the soot blackened the barks of the trees. If the air had become cleaner, and the trees' barks became lighter, then the moths would once again become lighter.

Explain the process that has lead to the changes in the moth population.

Animals must adapt to survive in their environment. The moth population had changed due to changes in their environment. In this case, that change was the colour of their habitat. Due to this, the moth's ability to camouflage was affected. As the trees became darker due to soot, the light moths were easily seen, and could be preyed upon easily. The dark moths, however, could now easily camouflage with the dark trees, increasing their rate of survival. As more dark moths were alive, more dark moths reproduced, and as they reproduced, the 'dark' gene was passed on. This process is known as natural selection. This resulted in an increase of dark coloured moths, and a decrease of light coloured moths. Therefore, the coal burning factories had a major impact on its environment, which can be seen through the process that led to the changes in the moth population.

Task 1.18 **U_2 response**	relates the change in moth population to individuals who survive an environmental change to reproduce and pass traits onto their offspring.

Predict what will happen to the population of moths if the air becomes cleaner.

A consequence of the air becoming cleaner would be less soot in the air, and therefore less soot to darken the bark of trees. Due to natural selection, the black moths survived against the darker background, because it was better suited to camouflage from predators. However, this advantage of the black peppered moth would diminish as the bark lightens, allowing white peppered moths to survive as well. Due to this the, I predict that the population of moths would change to having mostly white coloured moths

Explain the process that has lead to the changes in the moth population.

The process that has led to this change is natural selection. Natural selection is a process that acts upon living organisms, favouring certain characteristics and features. Predators, such as birds, act as a selective agent on the moths. The black moths would be better camouflaged against the dark background of the black bark of the trees, while the white moths would stand out. Due to this, these predators would kill and eat these white moths, preventing them from breeding and passing on their genes that code for this white characteristic. The black moth however would survive and be able to breed, passing on this black characteristics to its offspring. Some of their offspring however may still be white. This process of selection by the selective agent continues, only allowing the black moths to survive and reproduce due to their advantage over white moths. As generations of moths pass, there would be more and more black moths, eventually changing the population of moths from mostly light coloured, to mostly dark coloured. Thus, the process that has led to this change in the moth population is a result of natural selection