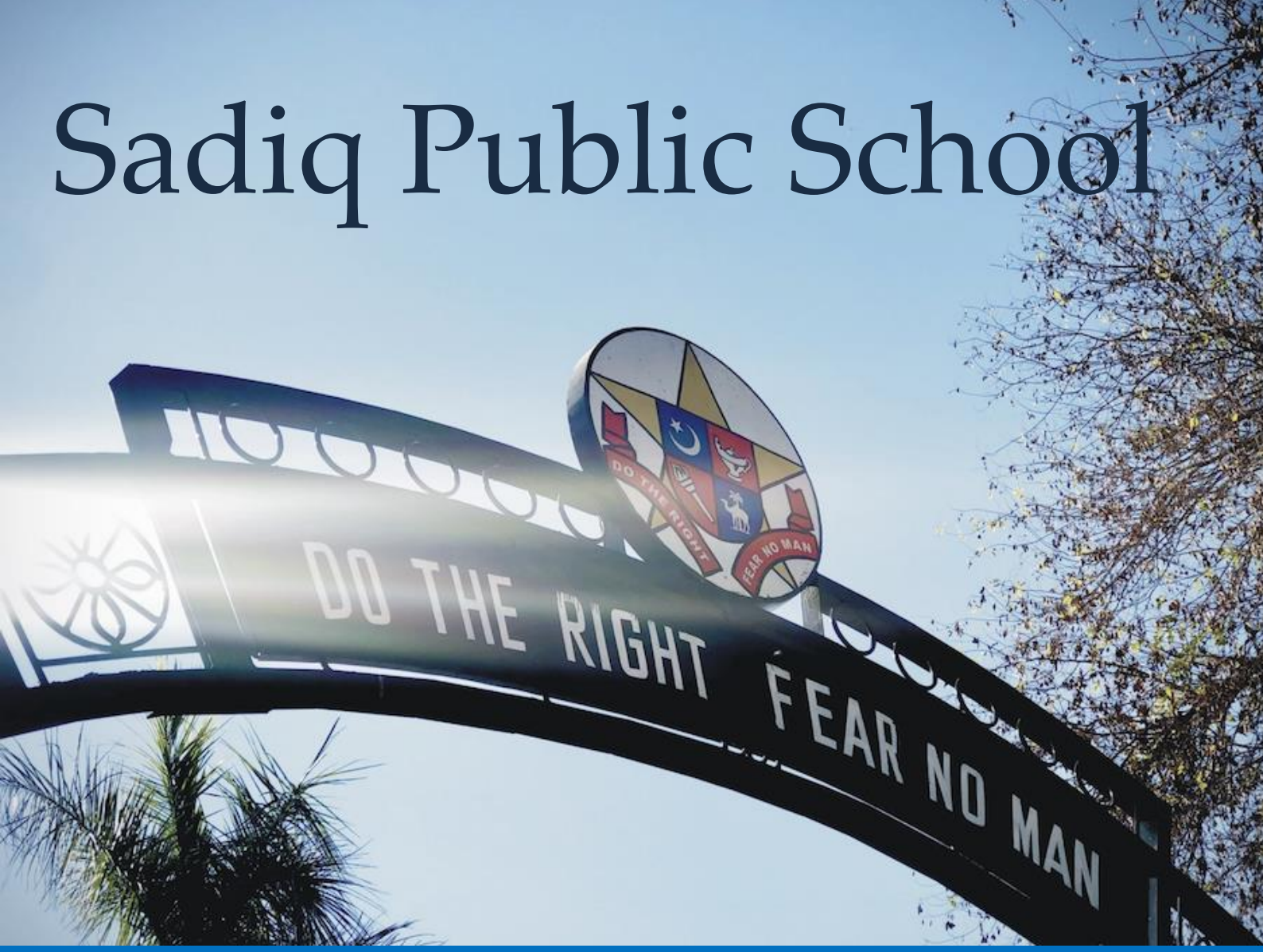
Sadiq Public School



Distance Learning for H2

August-September 2020

Sadiq Public School

Do the right, fear no man

Distance Learning

July, 2020

Dear students and parents,

Assalam o aleikum.

Inshallah all of our students and their families are staying home, staying safe, and protecting themselves and their communities in this most unusual situation. We understand as well as anyone how difficult it is to be living in such a situation. If we all follow the government's very simple guidance the situation will improve very soon, as it has in many countries around the world, and our lives can get back to normal.

The Government has announced that Schools will likely be allowed to re-open on September 15th, 2020. Let me be clear – Sadiq Public School is planning for a full school year from September 15th 2020, i.e. with the appropriate number of school days to ensure our students complete their normal syllabuses well in time for their annual examinations without compromising too much on the remainder of our unique, holistic curriculum that includes sports, clubs, and community service – and self-discipline (doing the right thing at the right time).

After a considerable amount of thought and planning, after considering the many factors associated with distance learning including health and safety risks to children of being online for too long and unsupervised, costs of technology/devices/software, and the expected/likely outcomes, we have decided to offer a package of distance learning activities for students to do some school work. These activities are NOT intended to replace in-school, teacher-student learning activities and they are NOT compulsory for students to complete. The team of education experts at Sadiq Public School very strongly believe that education, i.e. meaningful learning, happens best when teachers and students interact, face to face, spontaneously.

This booklet has been prepared by a small team of subject teachers with help from the IT Department's staff. I am very grateful for their efforts!!

We also understand that the Sadiq Public School family is very diverse and what will work well for a K2 student living in Bahawalpur probably will not for a K2 student living in Quetta or a P6 student living in Karachi. This is a self-contained, age-specific package of learning material prepared by SPS teachers for SPS students. You will not need

to use the internet and you will not need textbooks or any other material except a normal, lined school notes book (a separate one for each subject) which you will bring back to school when lessons resume. We decided to create an e-booklet so it can be published and distributed to students and parents without needing to be printed and sent by post/courier out of concern for our environment. (There is an interesting hypothesis that the coronavirus outbreak is due to deforestation.)

Everyone's health is the top concern right now. Learning some mathematics right now is less important than protecting your health and your family's health. Not just your physical health, but also your mental health. We understand that these last few and next few months have been and will be difficult. It is very normal for everyone to be feeling worried and anxious. In such times, it is important to recognise your anxiety, understand what is causing it, and learn how to manage it by being kind to yourself, patient with others, eating well, sleeping well, doing some physical activity (there's a whole section about this later in the booklet), and trying to maintain a positive outlook. The virus outbreak will pass. We will all return to our normal lives. Inshallah!

Be happy. Not because everything is good, but because you can see some good in everything.

Yours Sincerely,

Mr Peter Giddens
Principal

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How to achieve academic success at Sadiq Public School

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How to achieve academic success at Sadiq Public School

Our approach to teaching and learning is based on the knowledge that learning only occurs when cognitive effort is generated to the extent that information is made into a long-term memory that can be readily recalled. We use traditional teaching methods informed by current research in education and pedagogical practices.

The Sadiq Public School approach is based on:

1. Teachers impart knowledge and skills using a variety of media – talking/lecturing, written notes and diagrams on a whiteboard, demonstrations, initiating practical activities for students to experience what is being learnt.
2. All lessons are taught on the assumption that as the course unfolds, students are creating their own class notes.
3. Students use one standard textbook for each subject; the book recommended by the School. Students possess and use one lined or gridded copy book per subject, into which class notes are created. (Thinner books with less pages are preferable, to minimise the weight being carried from lesson to lesson. If students require, additional copy books should be used – but always a separate book for separate subjects.
4. A student's class notes are created from a combination of teacher-guided media and student-created media.
5. The class notes should replicate/mirror the course outline and the textbook chapter headings so that students can clearly see that their class notes match the course and the examination.
6. Teachers will show students how to use note-taking/making techniques such as underlining, using different colours, diagrams, lists, boxes, etc.
7. In general, the first half of the copy book is for class notes and the second half, indicated with some form of marker is for practice activities, e.g. homework tasks, the questions at the end of a textbook chapter, etc.
8. Students MUST keep a complete and neatly presented set of class notes. If a student misses a lesson, it is his/her responsibility to add in missed work. This may be done by copying another student's copy book.
9. Frequently, teachers will check students' copy books for completion, neatness, accuracy, etc., and to write personalised / individualised feedback to students.
10. Occasional paper handouts may be trimmed and pasted neatly into a copy book, but this should be kept to a minimum because the act of writing/drawing the class notes into the copy book is the student's first step in learning the material being taught by the teacher. Pasting handouts into copy books teaches students how to use a glue stick and scissors; it does not teach a student anything about the material on the handout.

Writing class notes is the basis of our teaching and learning – but of course this is supported by other experiences such as demonstrations, practical activities, etc.

Examination preparation

In the weeks before examinations, students would typically use the class notes and text book to create a set of study notes by re-writing, often in short-hand/note form, using diagrams and mnemonics etc. Doing this reinforces and consolidates the student's class notes. Students would also complete the questions at the end of each chapter on their own. They would attend lessons and, under the teacher's supervision, complete individual exam questions from past papers, in such a way that the teacher 'unpacks' a question, clarifies the demands of the question, and students and teacher collectively create 'perfect' exam answers – all of which models how a student would take an examination, i.e. read the question, unpack the requirements of the question, clarify key terms/vocabulary in the question, pause, think, plan an answer, and then write an answer.

If you can, now is a good time to buy and prepare your notes books for each subject, ready for when you return to school.

You can use these notes books to write your answers/essays/responses to the activities in this booklet.

1. Mathematics

Pure Mathematics

Q1) The equation of the curve is $y = x^2e^{-x}$.

i) Find the x coordinates of stationary points of the curve and determine the nature of these stationary points.

ii) Show that the equation of the normal to the curve at the point where x = 1 is

$$e^2x + ey = 1 + e^2.$$

Q2)

i) Use laws of logarithms to help differentiate the given expression with respect to x:

$$ln\left[\frac{3-x}{(x+4)(x-1)}\right]$$

ii) Find $\frac{dy}{dx}$ in terms of x, for $e^y = (x+1)(x-5)$

Q3) The equation of a curve is $y^3 - 12xy + 16 = 0$.

i) Show that the curve has no stationary points.

ii) Find the coordinates of the point on the curve where tangent is parallel to y-axis.

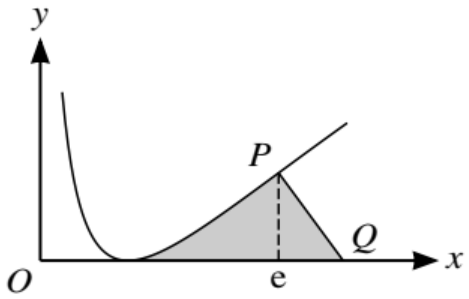
Q4) A curve has equation $\boldsymbol{y = \frac{sin\,2x}{e^{2x}}}$ for $0 < x < \frac{\pi}{2}$. Find the exact value of x-coordinate of the stationary point of this curve.

Q5) The parametric equations of a curve are $= t + 4\,ln\,t$, $y = t + \frac{9}{t}$, for $t > 0$.

i) Show that $\frac{dy}{dx} = \frac{t^2-9}{t^2+4t}$.

ii) The curve has one stationary point. Find the y-coordinate of this point and determine whether it is a maximum or a minimum point.

Q6) The diagram shows the curve $y = (\ln x)^2 y$. The x-coordinate of the point P is equal to e, and the normal to the curve at P meets the x-axis at Q.



i) Find x-coordinate of Q.

ii) Show that $\int \ln x \, dx = x\ln x - x + c$, where c is a constant.

iii) Using integration by parts, or otherwise, find the exact value of the area of the shaded region between the curve, the x-axis and the normal PQ.

Q7) Given that a is a positive constant, solve the inequality $|\boldsymbol{x - 3a}| > |\boldsymbol{x - a}|$.

Q8) Find the values of x satisfying the inequality $|3^x - 8| < 0.5$, giving 3 significant figures in answer.

Q9) Solve the inequality $|x - 4| < 2|3x + 1|$.

Q10) The polynomial $5x^3 - 13x^2 + 17x - 7$ is denoted by $P(x)$.

i) Find the quotient when $P(x)$ is divided by $(x - 1)$ and show that the remainder is 2.

ii) Hence show that the polynomial $5x^3 - 13x^2 + 17x - 7$ has exactly one real root.

Q11) The polynomial $ax^3 + bx^2 + x + 3$, where a and b are constants, is denoted by $p(x)$. It is given that $(3x + 1)$ is a factor of $p(x)$, and that when $p(x)$ is divided by $(x - 2)$ the remainder is 21. Find the values of a and b.

Q12) Solve the inequality $|x| < |5 + 2x|$.

Q13) The polynomial $x^4 + 3x^3 + ax + 3$ is denoted by $p(x)$. It is given that $p(x)$ is divisible by $x^2 - x + 1$.

i) Find the value of a.

ii) When a has this value, find the real roots of the equation $p(x) = 0$.

Q14) i) The polynomial $f(x)$ is of the form $(x - 2)^2 g(x)$, where $g(x)$ is another polynomial. Show that $(x - 2)$is a factor of $f'(x)$.

ii) The polynomial $x^5 + ax^4 + 3x^3 + bx^2 + a$, where a and b are constants, has a factor $(x - 2)^2$.

Using the factor theorem and the result of part **(i)**, or otherwise, find the values of a and b.

Q15) Let $f(x) = \frac{(x^2 - 8x + 9)}{(1 - x)(2 - x)^2}$.

i) Express $f(x)$ in partial fractions.

ii) Hence obtain the expansion of $f(x)$ in ascending powers of x, up to and including the term in x^2.

Q16) Use logarithms to solve the equation $e^x = 3^{x-2}$ and give your answer correct to 3 decimal places.

Q17) Find the set of values of x for which $3(2)^{3x+1} < 8$. Give your answer in a simplified form.

Q18) a) Expand $(1 + 3x)^{\frac{-1}{3}}$ in ascending powers of x, up to and including the term in x^2, simplifying the coefficients.

b) State the set of values of x for which the expansion is valid.

Q19) **a)** Sketch the graph of $y = 2x - 3$.

b) Solve the inequality $3x - 1 > 2x - 3$.

Q20) The parametric equations of a curve are

$$x = e^{2t-3}, y = 4 \ln t,$$

where $t > 0$. When $t = a$ the gradient of the curve is 2.

i) Show that a satisfies the equation $a = \frac{1}{2}(3 - \ln a)$.

ii) Verify by calculation that this equation has a root between 1 and 2.

iii) Use the iterative formula $a_{n+1} = \frac{1}{2}(3 - \ln a_n)$ to calculate a correct to 2 decimal places, showing the result of each iteration to 4 decimal places.

Q21) **a)** Show that $\frac{d}{dx}(x - \tan^{-1} x) = \frac{x^2}{1+x^2}$.

b) Show that $\int_0^{\sqrt{3}} x - \tan^{-1} x \, dx = \frac{2}{3}\pi - \frac{1}{2}\sqrt{3}$.

Q22) The complex numbers $1 + 3i$ and $4 + 2i$ are denoted by u and v respectively.

a) Find $\frac{v}{u}$ in the form $x + iy$, where x and y are real.

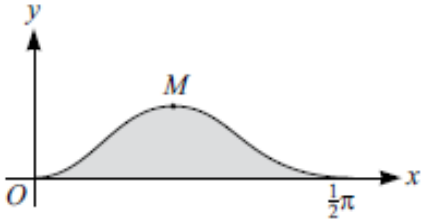
b) State the argument of $\frac{v}{u}$.

Q23) **a)** By first expanding $\cos(x + 45°)$, express $\cos(x + 45°) - \sqrt{2} \sin x$ in the form $R \cos(x + \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. Give the value of R correct to 4 significant figures and the value of α correct to 2 decimal places.

b) Hence solve the equation:

$$\cos(x + 45°) - \sqrt{2} \sin x = 2, \text{ for } 0 < x < 360 .$$

Q24)



The diagram shows the curve $y = \sin^2 2x \cos x$ for $0 \leqslant x \leqslant \frac{1}{2}\pi$ and its maximum point M.

a) Find the *x*-coordinate of *M*.

b) Using the substitution $u = \sin x$, find the area of the shaded region bounded by the curve and the *x*-axis.

Q25) The curve with equation $y = \frac{e^{-2x}}{1-x^2}$ has a stationary point in the interval $-1 < x < 1$.

Find $\frac{dy}{dx}$ and hence find the *x*-coordinate of this stationary point, giving the answer correct to 3 decimal places.

Q26) The equation of a curve is $2x^2y - xy^2 = a^3$, where a is a positive constant. Show that there is only one point on the curve at which the tangent is parallel to the $x-axis$ and find the $y-coordinate$ of this point.

Q27) The variables x and θ satisfy the differential equation:

$$\sin\frac{1}{2}\theta\frac{dx}{d\theta} = (x+2)\cos\frac{\theta}{2} \text{ for } 0 < \theta < \pi.$$

It is given that $x = 1$ when $\theta = \frac{\pi}{3}$. Solve the differential equation and obtain an expression for x in terms of $cos\theta$.

Q28) Let $f(x) = \frac{2x^2+x+8}{(2x-1)(x^2+2)}$

.

i) Express $f(x)$ in partial fractions.

ii) Hence, showing full working, find $\int_1^5 f(x)dx$, giving the answer in the form $ln\ c$, where c is an integer.

Q29) Let $f(x) = \frac{5x^2+x+27}{(2x+1)(x^2+9)}$

.

i) Express $f(x)$in partial fractions.

ii) Hence find $\int_0^4 f(x)dx$, giving your answer in the form $ln\ c$, where c is an integer.

Q30) Expand $(1+x)\sqrt{(1-2x)}$ in ascending powers of *x*, up to and including the term in x^2, simplifying the coefficients.

6. List of formulae and tables of the normal distribution

PURE MATHEMATICS

Algebra

For the quadratic equation $ax^2 + bx + c = 0$:

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

For an arithmetic series:

$$u_n = a + (n-1)d\,, \qquad S_n = \tfrac{1}{2}n(a+l) = \tfrac{1}{2}n\{2a + (n-1)d\}$$

For a geometric series:

$$u_n = ar^{n-1}\,, \qquad S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)\,, \qquad S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

Binomial expansion:

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \binom{n}{3}a^{n-3}b^3 + \cdots + b^n\,,$$ where n is a positive integer

and $$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{3!}x^3 \cdots,$$ where n is rational and $|x| < 1$

Trigonometry

$$\text{Arc length of circle} = r\theta \quad (\theta \text{ in radians})$$

$$\text{Area of sector of circle} = \tfrac{1}{2}r^2\theta \quad (\theta \text{ in radians})$$

$$\tan\theta \equiv \frac{\sin\theta}{\cos\theta}$$

$$\cos^2\theta + \sin^2\theta \equiv 1\,, \qquad 1 + \tan^2\theta \equiv \sec^2\theta\,, \qquad \cot^2\theta + 1 \equiv \operatorname{cosec}^2\theta$$

$$\sin(A \pm B) \equiv \sin A\cos B \pm \cos A\sin B$$

$$\cos(A \pm B) \equiv \cos A\cos B \mp \sin A\sin B$$

$$\tan(A \pm B) \equiv \frac{\tan A \pm \tan B}{1 \mp \tan A\tan B}$$

$$\sin 2A \equiv 2\sin A\cos A$$

$$\cos 2A \equiv \cos^2 A - \sin^2 A \equiv 2\cos^2 A - 1 \equiv 1 - 2\sin^2 A$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

Principal values:

$$-\tfrac{1}{2}\pi \leq \sin^{-1}x \leq \tfrac{1}{2}\pi$$

$$0 \leq \cos^{-1}x \leq \pi$$

$$-\tfrac{1}{2}\pi < \tan^{-1}x < \tfrac{1}{2}\pi$$

Differentiation

$\mathrm{f}(x)$	$\mathrm{f}'(x)$
x^n	nx^{n-1}
$\ln x$	$\frac{1}{x}$
e^x	e^x
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
uv	$u\frac{\mathrm{d}v}{\mathrm{d}x}+v\frac{\mathrm{d}u}{\mathrm{d}x}$
$\frac{u}{v}$	$\frac{v\frac{\mathrm{d}u}{\mathrm{d}x}-u\frac{\mathrm{d}v}{\mathrm{d}x}}{v^2}$

If $x=\mathrm{f}(t)$ and $y=\mathrm{g}(t)$ then $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{\mathrm{d}y}{\mathrm{d}t}\div\frac{\mathrm{d}x}{\mathrm{d}t}$

Integration

$\mathrm{f}(x)$	$\int \mathrm{f}(x)\,\mathrm{d}x$
x^n	$\frac{x^{n+1}}{n+1}+c \quad (n\neq -1)$
$\frac{1}{x}$	$\ln\lvert x\rvert+c$
e^x	e^x+c
$\sin x$	$-\cos x+c$
$\cos x$	$\sin x+c$
$\sec^2 x$	$\tan x+c$

$$\int u\frac{\mathrm{d}v}{\mathrm{d}x}\,\mathrm{d}x=uv-\int v\frac{\mathrm{d}u}{\mathrm{d}x}\,\mathrm{d}x$$

$$\int\frac{\mathrm{f}'(x)}{\mathrm{f}(x)}\,\mathrm{d}x=\ln\lvert\mathrm{f}(x)\rvert+c$$

Vectors

If $\mathbf{a}=a_1\mathbf{i}+a_2\mathbf{j}+a_3\mathbf{k}$ and $\mathbf{b}=b_1\mathbf{i}+b_2\mathbf{j}+b_3\mathbf{k}$ then

$$\mathbf{a}.\mathbf{b}=a_1b_1+a_2b_2+a_3b_3=|\mathbf{a}||\mathbf{b}|\cos\theta$$

Numerical integration

Trapezium rule:

$$\int_a^b \mathrm{f}(x)\,\mathrm{d}x\approx\tfrac{1}{2}h\{y_0+2(y_1+y_2+\cdots+y_{n-1})+y_n\},\ \text{where}\ h=\frac{b-a}{n}$$

2. Physics

Circular Motion

Angular Displacement

Angle subtended at the centre of the circle when a body rotates about a fixed point is called angular displacement.

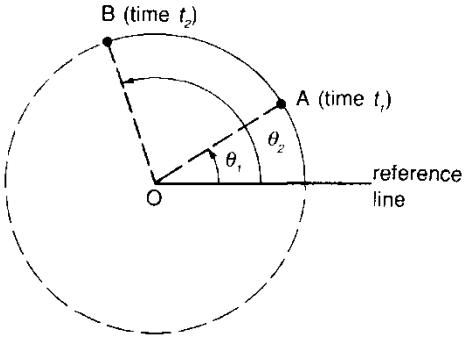
Consider a particle moving from point A to point *B.* The angular displacement in this case is

$$\angle AOB = \theta_2 - \theta_1$$

Angular displacement is measured in radians (rad).

The time taken for the particle to move from point A to point *B* is

$$\Delta t = t_2 - t_1$$



Radian

One radian is the angle subtended at the centre of the circle by an arc of the circle equal in length to its radius.

1 degree = /180 radian

Angular Velocity

The rate of change of angular displacement is called angular velocity. It is denoted by ω.

The average angular velocity is $<\omega> = (\theta_2 - \theta_1) / (t_2 - t_1)$.

The unit is rad s^{-1}.

Points to note:

i. The symbol < > means average.

ii. Both angular displacement and angular velocity are vectorial quantities.

iii. If the particle has an angular displacement which depends on time, then we can speak of an instantaneous angular velocity, $\omega = d\theta / dt$.

Period

The time taken for the object to complete one rotation is called period. It is denoted by T.

Relation between period and angular velocity:

If T is the period and ω is the angular velocity then

T = angular displacement in a complete rotation / angular velocity

Or

$$T = 2 / \omega$$

Or

$$\omega = 2 / T$$

Relation between period and frequency:

We know f = number of rotations / time

And T = time / number of rotations

$\therefore$ $f = 1 / T$

Or $T = 1 / f$

Relation between period and angular frequency

We know

$\omega = 2 / T$

and

$T = 1/ f$

or

$\omega = 2 f$

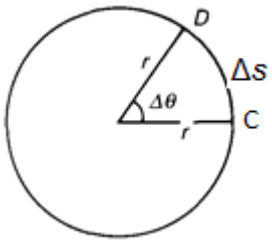
Q. Find the angular velocity of the second hand of a watch.

Q. Find the angular velocity of the hour hand of a watch.

Tangential velocity

Let a particle travel around a circle with uniform angular velocity, ω. Let the length of the arc *CD* be Δs.

The arc of a circle is related to the radius and the angle subtended at its centre as follows:



$$\Delta s = r\Delta\theta$$

If the time taken to go from C to *D* is Δt, then

$$\Delta s / \Delta t = r\Delta\theta / \Delta t$$

Or $v = r\omega$.

Q. A toy train moves round a circular track of diametre 0.70 m, completing one revolution in 10 seconds. Calculate, for this train:

a) The linear speed,

b) The angular speed,

(0.22 m s^{-1}, 0.63 rad s^{-1})

Centripetal acceleration (acceleration in a circle)

For any particle to move in a circular path, there must be a net force directed towards the centre of the circle to provide an acceleration, known as the centripetal acceleration. It is always directed towards the centre of the circle. It is denoted by a_c.

The centripetal acceleration is given by

$$a_c = \frac{v^2}{r} = r\omega^2$$

where *r* is the radius of the circular path.

Centripetal force

The force which compels the body to move in a circular path is called centripetal force. This force is always directed towards the centre of the circle. It is denoted by F_c.

$$F_c = m\frac{v^2}{r} = m\,r\omega^2$$

Q. A turntable of a record player rotates with a uniform angular velocity of 2 rev/min. It is noticed that a penny of mass 50 g stays on top of the turntable. If its distance from the axis of rotation is less than 5 cm, explain this observation and calculate the frictional force between the penny and the turntable.

Q. (a) (i) Define the *radian*.

(ii) A small mass is attached to a string. The mass is rotating about a fixed point P at constant speed, as shown in Fig. 1.

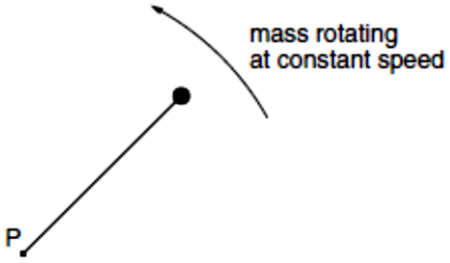


Fig. 1

Explain what is meant by the *angular* speed about point P of the mass.

(b) A horizontal flat plate is free to rotate about a vertical axis through its centre, as shown in Fig. 2.

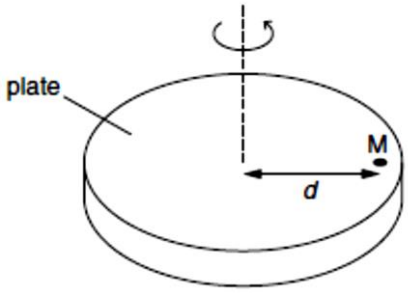


Fig. 2

A small mass M is placed on the plate, a distance d from the axis of rotation.

The speed of rotation of the plate is gradually increased from zero until the mass is seen to slide off the plate.

The maximum frictional force F between the plate and the mass is given by the expression

$$F = 0.72W,$$

where W is the weight of the mass M.

The distance d is 35 cm.

Determine the maximum number of revolutions of the plate per minute for the mass M to remain on the plate.

(c) The plate in **(b)** is covered, when stationary, with mud.

Suggest and explain whether mud near the edge of the plate or near the centre will first leave the plate as the angular speed of the plate is slowly increased.

Q. A vertical peg is attached to the edge of a horizontal disc of radius *r*, as shown in Fig. 1.

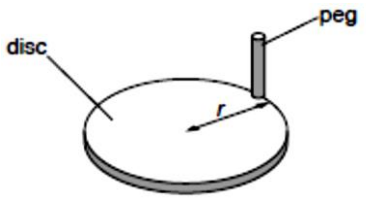


Fig. 1

The disc rotates at constant angular speed ω. A horizontal beam of parallel light produces a shadow of the peg on a screen, as shown in Fig. 2.

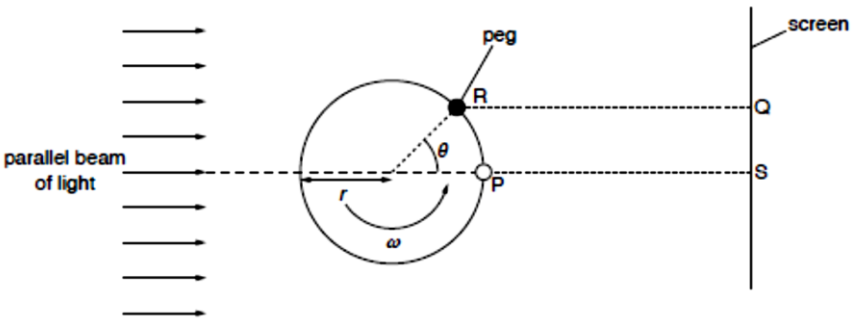


Fig. 2 (plan view)

At time zero, the peg is at P, producing a shadow on the screen at S.

At time *t*, the disc has rotated through angle θ. The peg is now at R, producing a shadow at Q.

(a) Determine in terms of ω and *t*, the angle θ,

(b) The disc has radius *r* of 12 cm and is rotating with angular speed ω of 4.7 rad s^{-1}.

Determine

(i) the frequency of oscillation,

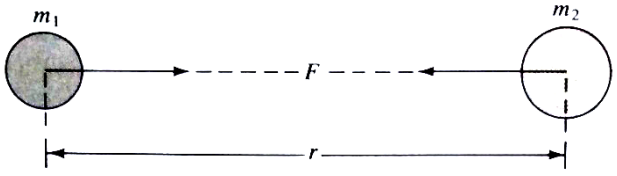
(ii) its maximum speed.

(iii) and state the relation between angular velocity (ω) and period (T)

Gravitation

Newton in his Law of Universal Gravitation

Newton's Law of Universal Gravitation states that the force of attraction between two objects is directly proportional to the product of the masses of the objects and inversely proportional to the square of the distance between them. The force of attraction acts along the line joining the centres of the two bodies.



That is, $F \propto \frac{m_1 m_2}{r^2}$

$F = \frac{G m_1 m_2}{r^2}$

where G is known as the universal constant of gravity. G = 6.67 x 10^{-11} kg^{-1} m^3 s^{-2}. (N m^2 kg^{-2})

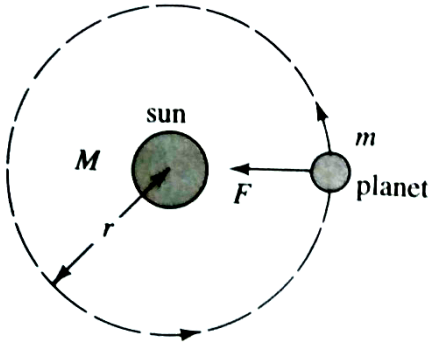
Relationship between G and g

$g = GM_E / R^2$

or $gR^2 = GM_E$

Relationship between Period and Radius of Orbit of a Planet

Suppose that a planet of mass m is in a circular orbit of radius r around the sun of mass M.



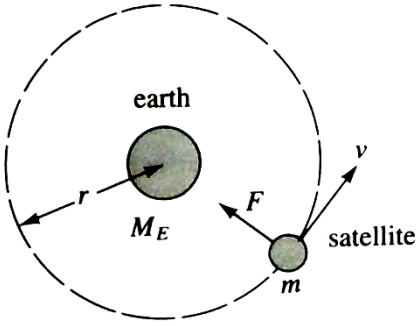
The centripetal force is the gravitational attraction on the planet by the sun

$$\frac{T^2}{r^3} = \frac{4\pi^2}{GM} = \text{constant}.$$

Or $T^2 \alpha r^3$

Satellite System of the Earth

To launch a satellite, it is first carried to the required distance from the earth. Then the satellite is launched in a direction parallel to the earth's surface with a definite velocity v as shown in Fig.



$$v = \sqrt{\frac{GM_E}{r}}$$

Q. How far from the earth, along the line joining the earth and the sun, would the gravitational attraction on an object by the sun be balanced by the gravitational attraction of the earth?

(Distance between earth and sun is 1.5 x 10^{11} m, mass of sun is 3.24 x 10^5 M_E, M_E = mass of earth.)

Q. For a satellite which is close to the earth's surface, its radius of orbit may be assumed to be equal to the earth's radius = 6.4 x 10^6 m.

a) Estimate the speed, and
b) the period of the satellite.

Gravitational Field

A gravitational field is a force field. This field exists around a mass. Another mass introduced into the field will experience a force.

Variation of g with Distance from the Centre of the Earth

From the surface of the earth upwards (r R)

For a mass m at a distance r (r R) from the centre of the earth, the gravitational field strength is

$$g = G M / r^2$$

or

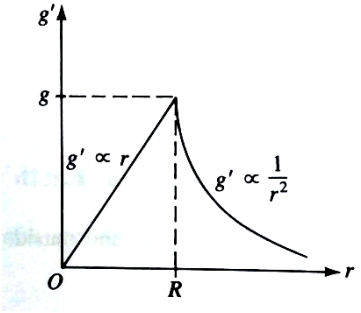
$$g' \propto \frac{1}{r^2} \qquad (\text{if } r \geq R)$$

Variation of g with Distance below the Earth's Surface

$$g' = \frac{G}{r^2}\left(\frac{4}{3}\pi r^3 \rho\right)$$

Or $$g' \propto r \qquad (r < R)$$

The graph in Fig. summarises the results of the discussion.



Q. On the ground, the gravitational force on a satellite is W. At a height of R/50, where R is the radius of the earth, what is the gravitational force on the satellite?

Q. What is the period of a second-pendulum (period = 2 s on the earth) when it is on the moon's surface? (Mass of moon = 7.35 x 10^{22} kg, radius of moon = 1 720 km; mass of earth = 6.0 x 10^{24} kg, radius of earth = 6.4 x 10^{6} m.)

3. Chemistry

1. Atomic symbols

Deduce the number of protons, neutrons and electrons in the following species:

1. $^{1}_{1}H$
2. $^{17}_{8}O$
3. $^{4}_{2}He^{2+}$
4. $^{132}_{54}Xe$
5. $^{27}_{13}Al^{3+}$
6. $^{235}_{92}U$
7. $^{1}_{1}H^{+}$
8. $^{45}_{21}Sc^{3+}$
9. $^{37}_{17}Cl^{-}$
10. $^{14}_{6}C$

Use the periodic table to write symbols for the following species:

11. 19 protons, 20 neutrons, 18 electrons
12. 8 protons, 8 neutrons, 10 electrons
13. 1 proton, 2 neutrons, 1 electron
14. 82 protons, 126 neutrons, 80 electrons
15. 53 protons, 74 neutrons, 54 electrons

2. electronic configuration

Write the electronic configuration of the following using the arrow and box method:

1. C
2. Cu
3. Mg^{+}

Write the electronic configuration of the following using the orbital method:

4. N^{3-}

5. Ar

6. Sc^{3+}

7. Mn^{2+}

8. Fe^{3+}

9. V^{3+}

Write the electronic configuration of the following using the shorthand arrow and box method:

10. Cl^-

11. Fe

12. Br

Write the electronic configuration of the following using the shorthand orbital method:

13. Cr

14. Ga^{3+}

15. Pb^{2+}

Test questions (Write the question and then the answer in your book).

Hydrogen peroxide is sold commercially as an aqueous solution containing approximately 60 g dm^{-3} of hydrogen peroxide.

(a) Use data from the Periodic Table to calculate the M_r of hydrogen peroxide. Give your answer to the appropriate precision.

(b) Calculate the concentration, in mol dm^{-3}, of a solution containing 60.0 g dm^{-3} of hydrogen peroxide.

(c) The concentration of hydrogen peroxide in a hair bleach is 0.050 mol dm^{-3}. Use your answer from (b) to calculate the dilution factor needed to make the commercial hydrogen peroxide solution suitable for use in this hair bleach. Show your working.

2. A chemist was asked to prepare a standard solution of sodium carbonate.
The chemist dissolved an accurately known mass of sodium carbonate in a small amount of water in a conical flask. The chemist then poured the solution into a 250 cm^3 graduated flask and made the solution up to the mark. Suggest **one** improvement to the chemist's procedure.

3. Zinc forms many different salts including zinc sulfate, zinc chloride and zinc fluoride.

(a) People who have a zinc deficiency can take hydrated zinc sulfate ($ZnSO_4.xH_2O$) as a dietary supplement.

A student heated 4.38 g of hydrated zinc sulfate and obtained 2.46 g of anhydrous zinc sulfate.

Use these data to calculate the value of the integer x in $ZnSO_4.xH_2O$
Show your working.

(b) Zinc chloride can be prepared in the laboratory by the reaction between zinc oxide and hydrochloric acid.
The equation for the reaction is

$$ZnO + 2HCl \longrightarrow ZnCl_2 + H_2O$$

A 0.0830 mol sample of pure zinc oxide was added to 100 cm^3 of 1.20 mol dm^{-3} hydrochloric acid.

Calculate the maximum mass of anhydrous zinc chloride that could be obtained from the products of this reaction.

(c) Zinc chloride can also be prepared in the laboratory by the reaction between zinc and hydrogen chloride gas.

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$$

An impure sample of zinc powder with a mass of 5.68 g was reacted with hydrogen chloride gas until the reaction was complete. The zinc chloride produced had a mass of 10.7 g.

Calculate the percentage purity of the zinc metal.
Give your answer to 3 significant figures.

4. In a titration, it is important to wash the inside of the titration flask with distilled or deionised water as you approach the end-point.

(a) Suggest **one** reason why it is important to wash the inside of the flask.

(b) Washing with water decreases the concentration of the reagents in the titration flask.

Suggest why washing with water does **not** affect the titre value.

5. Read the following instructions that describe how to make up a standard solution of a solid in a volumetric flask.
Answer the questions which follow.

'Take a clean 250 cm^3 volumetric flask. Use the balance provided and a clean, dry container, to weigh out the amount of solid required. Tip the solid into a clean, dry 250 cm^3 beaker and add about 100 cm^3 of distilled water. Use a stirring rod to help the solid dissolve, carefully breaking up any lumps of solid with the rod. When the solid has dissolved, pour the solution into the flask using a filter funnel. Add water to the flask until the level rises to the graduation mark.'

(a) Suggest **three** further instructions that would improve the overall technique in this account.

(b) In a series of titrations using the solution made up in part (a), a student obtained the following titres (all in cm^3).

Rough	1	2
25.7	25.20	25.35

State what this student must do in order to obtain an accurate average titre in this experiment.

6 Sodium hydroxide is often sold as a concentrated solution containing 12.0 mol dm^{-3} of sodium hydroxide.

Calculate the volume of water that should be added to 10.0 cm^3 of a 12.0 mol dm^{-3} solution of sodium hydroxide to make a 0.250 mol dm^{-3} solution. Show your working.

7. Ammonia is used to make nitric acid (HNO_3) by the Ostwald Process.
Three reactions occur in this process.

Reaction **1** $4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$

Reaction **2** $2NO(g) + O_2(g) \longrightarrow 2NO_2(g)$

Reaction **3** $3NO_2(g) + H_2O(I) \longrightarrow 2HNO_3(aq) + NO(g)$

(a) In one production run, the gases formed in Reaction **1** occupied a total volume of 4.31 m^3 at 25 °C and 100 kPa.

Calculate the amount, in moles, of NO produced.
Give your answer to 3 significant figures.
(The gas constant R = 8.31 J K^{-1} mol^{-1})

(b) In another production run, 3.00 kg of ammonia gas were used in Reaction **1** and all of the NO gas produced was used to make NO_2 gas in Reaction **2**.

(i) Calculate the amount, in moles, of ammonia in 3.00 kg.

(ii) Calculate the mass of NO_2 formed from 3.00 kg of ammonia in Reaction **2** assuming an 80.0% yield.
Give your answer in kilograms.
(If you have been unable to calculate an answer for part (b)(i), you may assume a value of 163 mol. This is **not** the correct answer.)

(c) Consider Reaction **3** in this process.

$3NO_2(g) + H_2O(I) \longrightarrow 2HNO_3(aq) + NO(g)$

Calculate the concentration of nitric acid produced when 0.543 mol of NO_2 is reacted with water and the solution is made up to 250 cm^3.

8. (a) Calcium phosphate reacts with aqueous nitric acid to produce phosphoric acid and calcium nitrate as shown in the equation.

$$Ca_3(PO_4)_2 + 6HNO_3 \longrightarrow 2H_3PO_4 + 3Ca(NO_3)_2$$

(i) A 7.26 g sample of calcium phosphate reacted completely when added to an excess of aqueous nitric acid to form 38.0 cm^3 of solution.

Calculate the concentration, in mol dm^{-3}, of phosphoric acid in this solution.
Give your answer to 3 significant figures.

(ii) Calculate the percentage atom economy for the formation of calcium nitrate in this reaction.
Give your answer to 1 decimal place.

(b) Write an equation to show the reaction between calcium hydroxide and phosphoric acid to produce calcium phosphate and water.

(c) Calcium dihydrogenphosphate can be represented by the formula $Ca(H_2PO_4)_x$ where x is an integer.
A 9.76 g sample of calcium dihydrogenphosphate contains 0.17 g of hydrogen, 2.59 g of phosphorus and 5.33 g of oxygen.

Calculate the empirical formula and hence the value of x.
Show your working.

9. (a) An unknown metal carbonate reacts with hydrochloric acid according to the following equation.

$$M_2CO_3(aq) + 2HCl(aq) \rightarrow 2MCl(aq) + CO_2(g) + H_2O(l)$$

A 3.44 g sample of M_2CO_3 was dissolved in distilled water to make 250 cm^3 of solution. A 25.0 cm^3 portion of this solution required 33.2 cm^3 of 0.150 mol dm^{-3} hydrochloric acid for complete reaction.

(i) Calculate the amount, in moles, of HCl in 33.2 cm^3 of 0.150 mol dm^{-3} hydrochloric acid. Give your answer to 3 significant figures.

(ii) Calculate the amount, in moles, of M_2CO_3 that reacted with this amount of HCl.
Give your answer to 3 significant figures.

(iii) Calculate the amount, in moles, of M_2CO_3 in the 3.44 g sample. Give your answer to 3 significant figures.

(iv) Calculate the relative formula mass, M_r, of M_2CO_3 Give your answer to 1 decimal place.

(v) Hence determine the relative atomic mass, A_r, of the metal M and deduce its identity.

A_r of M .....

Identity of M .....

(b) In another experiment, 0.658 mol of CO_2 was produced. This gas occupied a volume of 0.0220 m^3 at a pressure of 100 kPa.
Calculate the temperature of this CO_2 and state the units.
(The gas constant R = 8.31 J K^{-1} mol^{-1})

(c) Suggest **one** possible danger when a metal carbonate is reacted with an acid in a sealed flask.

(d) In a different experiment, 6.27 g of magnesium carbonate were added to an excess of sulfuric acid. The following reaction occurred.

$$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + CO_2 + H_2O$$

(i) Calculate the amount, in moles, of $MgCO_3$ in 6.27 g of magnesium carbonate.

(ii) Calculate the mass of $MgSO_4$ produced in this reaction assuming a 95% yield.

10. The metal lead reacts with warm dilute nitric acid to produce lead(II) nitrate, nitrogen monoxide and water according to the following equation.

$$3Pb(s) + 8HNO_3(aq) \longrightarrow 3Pb(NO_3)_2(aq) + 2NO(g) + 4H_2O(I)$$

(a) In an experiment, an 8.14 g sample of lead reacted completely with a 2.00 mol dm^{-3} solution of nitric acid.

Calculate the volume, in dm^3, of nitric acid required for complete reaction.
Give your answer to 3 significant figures

(b) In a second experiment, the nitrogen monoxide gas produced in the reaction occupied 638 cm^3 at 101 kPa and 298 K.
Calculate the amount, in moles, of NO gas produced.
(The gas constant R = 8.31 J K^{-1} mol^{-1})

(c) When lead(II) nitrate is heated it decomposes to form lead(II) oxide, nitrogen dioxide and oxygen.

(i) Balance the following equation that shows this thermal decomposition.

$$.....Pb(NO_3)_2(s) \longrightarrow ..... PbO(s) + ...NO_2(g) + ...O_2(g)$$

(1)

(ii) Suggest **one** reason why the yield of nitrogen dioxide formed during this reaction is often less than expected.

(iii) Suggest **one** reason why it is difficult to obtain a pure sample of nitrogen dioxide from this reaction.

11. A brand of fluoride tablets, recommended by a dentist to strengthen the enamel on teeth, contains 2.2×10^{-3} sodium fluoride per tablet. The total mass of fluoride ion present in 100 tablets is

A $2.2 \times 10^{-3} \times \frac{19}{42} \times 100$

B $2.2 \times 10^{-3} \times \frac{19}{23} \times 100$

C $2.2 \times 10^{-3} \times \frac{9}{20} \times 100$

D $\frac{100 \times 19}{2.2 \times 10^{-3}}$

(Total 1 mark)

12. When $TiCl_4$ is reduced with hydrogen under certain conditions, a new compound is produced which contains 68.9% chlorine by mass. Which one of the following could be the formula of the new compound?

A TiH_2Cl_2

B TiCl

C $TiCl_2$

D $TiCl_3$

13. Which one of the following samples of gas, when sealed into a vessel of volume 0.10 m^3, is at the highest pressure?

A 1.6 g of helium (He) at 100 K

B 1.6 g of methane (CH_4) at 100 K

C 1.6 g of oxygen (O_2) at 600 K

D 1.6 g of sulphur dioxide (SO_2) at 1200 K

14. Which one of the following compounds contains the smallest percentage, by mass, of oxygen?

A $CH_3OCH_2CH_3$

B $CH_3OCH_2NH_2$

C COS

D $C_4H_9Al(OH)_2$

15. Which one of the following contains the smallest number of moles of carbon dioxide gas?

A 2.65 g

B 0.0150 m^3 at 1000 K and 33.0 kPa

C 1.50 dm^3 at 327 °C and 200 kPa

D 1500 cm^3 at 300 K and 100 kPa

16. Use the information below to answer this question.

A saturated solution of magnesium hydroxide, $Mg(OH)_2$, contains 0.1166 g of $Mg(OH)_2$ in 10.00 dm^3 of solution. In this solution the magnesium hydroxide is fully dissociated into ions.

Which one of the following is the concentration of $Mg^{2+}(aq)$ ions in the saturated solution?

A 2.82×10^{-2} mol dm^{-3}

B 2.00×10^{-3} mol dm^{-3}

C 2.82×10^{-3} mol dm^{-3}

D 2.00×10^{-4} mol dm^{-3}

17. A particular sample of iron ore contains 85% by mass of Fe_2O_3 (M_r= 159.6) and no other iron compound. The maximum mass of iron that could be extracted from 1.0 tonne of this ore is

A 0.59 tonne

B 0.66 tonne

C 0.75 tonne

C 0.85 tonne

18. Sodium hydrogencarbonate decomposes on heating as shown by the equation below.

$$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$$

The volume of carbon dioxide, measured at 298 K and 101 kPa, obtained by heating 0.0500 mol of sodium hydrogencarbonate is

A 613 cm^3

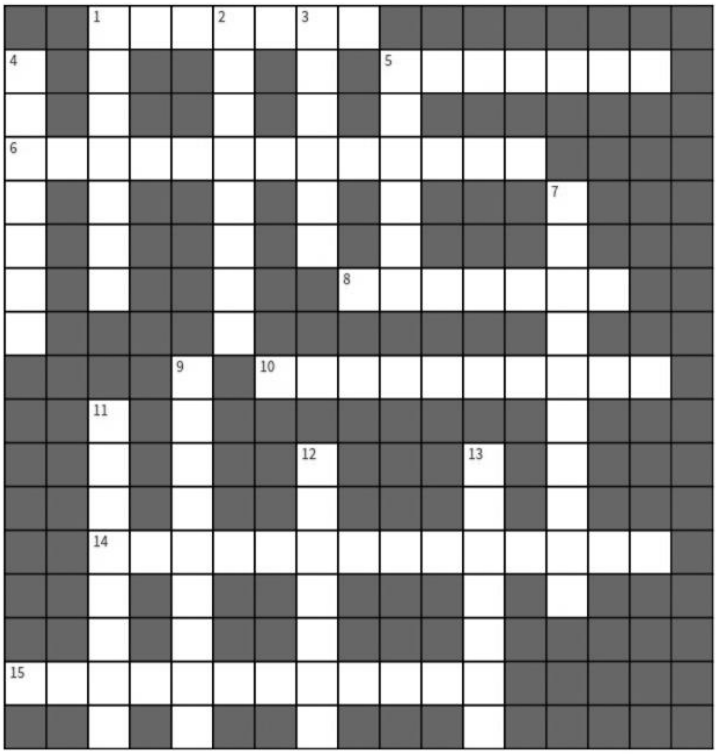
B 1226 cm^3

C 613 dm^3

D 1226 dm^3

Source: https://mathsmadeeasy.co.uk/a-level-chemistry-revision

Activity iv: Solve the following crossword



Across

1 Hydrocarbons consisting of molecules with only single bonds between their carbon atoms (7)

5 The alcohol produced by fermentation of sugars (7)

6 An anagram of 'storming teeth' - this type of polymer has covalent bonds between its polymer chains (13)

8 Compounds with the same chemical formula but different structures (7)

10 This sort of series is a 'family' of organic compounds (10)

14 Toxic gas formed by incomplete combustion of hydrocarbons (6,8)

15 Sounds a bit wet - nylon and polyester are examples of this type of polymer (12)

Down

1 Hydrocarbons consisting of molecules with at least one C=C bond (7)

2 A homologous series of compounds containing the hydroxyl group, –OH (8)

3 The simplest alkene (6)

4 The simplest alkane (7)

5 Fruity substances made by reacting an alcohol with a carboxylic acid (6)

7 Type of organic acid containing the –COOH group (10)

9 Describes a hydrocarbon containing no C=C bonds (9)

11 Process used to break larger alkanes into smaller alkanes and alkenes (8)

12 This food flavouring is a dilute solution of ethanoic acid (7)

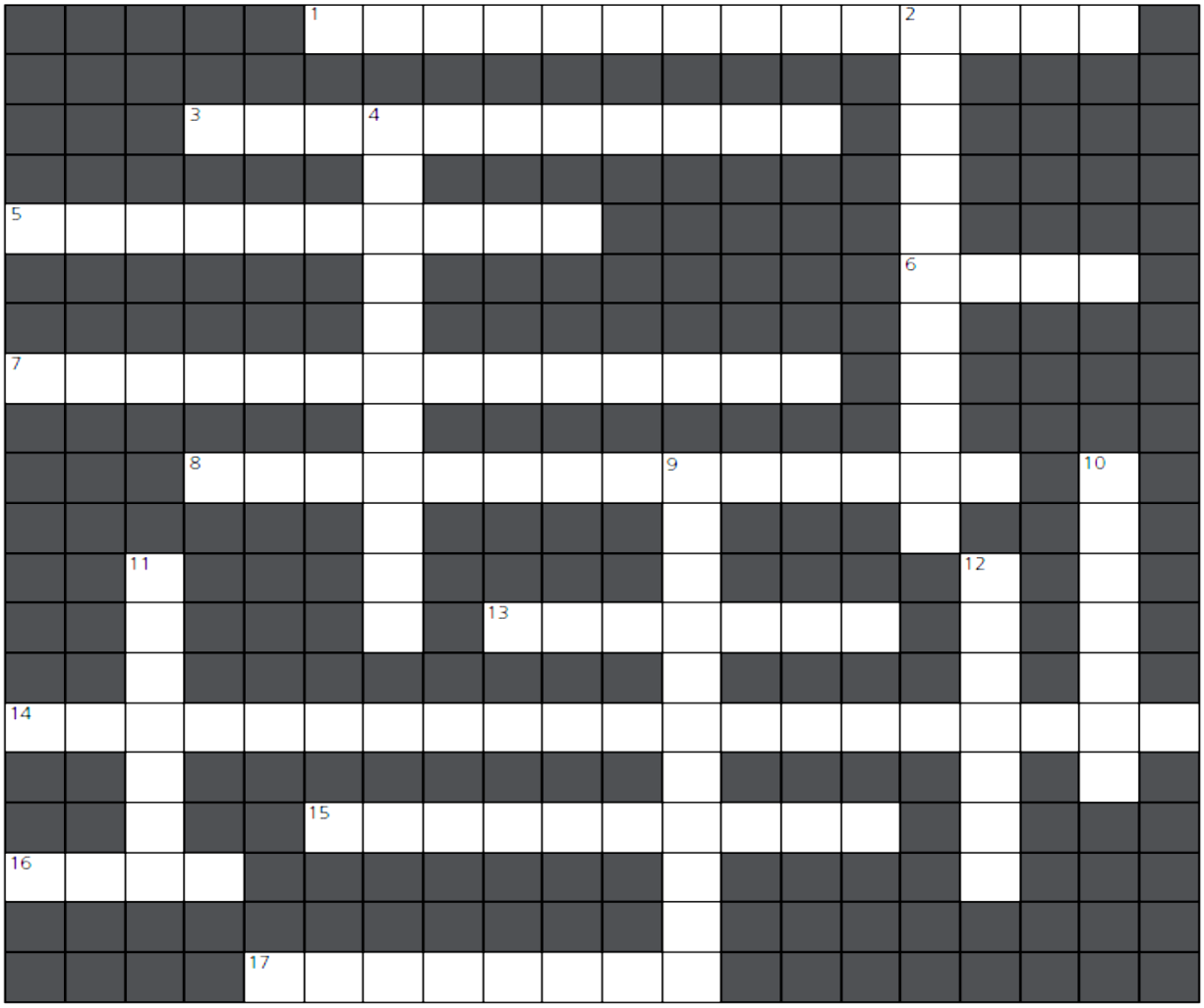
13 Orange-brown element that turns colourless when mixed with alkenes (7)

4. Biology

Q1. **The importance of DNA**

DNA is the molecule which carries the coded information responsible for all of the characteristics of organisms. The structure of this molecule was not worked out until 1953, and an entire new branch of biology—molecular biology—has developed since that discovery. This exercise will remind you of some of the key features of this molecule.

Crossword



Across

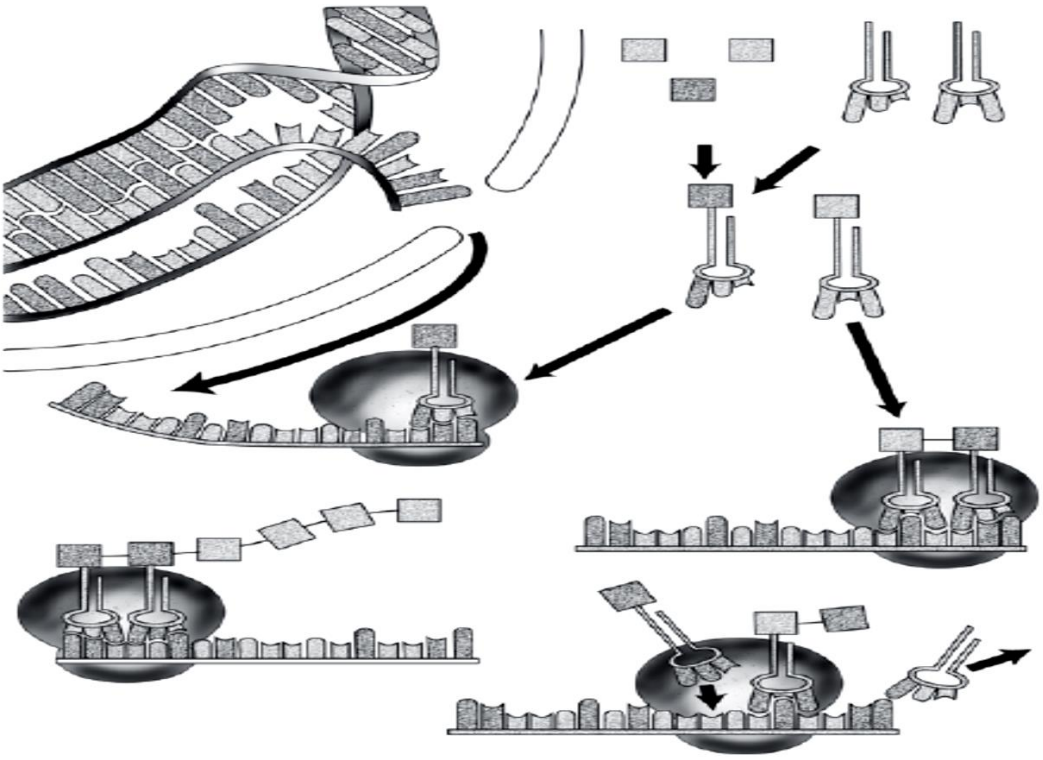
1 makes up the backbone of the DNA molecule
3 the twisted ladder of DNA (6, 5)
5 found in the nucleus and made up of DNA
6 a section of DNA that codes for a single protein
7 two scientists who suggested the structure of DNA (6, 3, 5)
8 another name for a 'feature' of an organism
13 control centre of the cell—this is where you would look for DNA
14 …. or DNA for short!
15 one of the subunits that makes up DNA
16 one of the molecules that make up the rungs of the DNA ladder
17 female scientist who helped in understanding the structure of DNA

Down

2 a protein found in red blood cells
4 a rule that 'links' the two chains of the DNA molecule (4, 7)
9 the copying of DNA
10 the pigment responsible for skin colour
11 type of cell division that produces exact copies
12 protein molecule found in hair cells

Q.2 DNA controls protein synthesis.

Proteins are synthesized within the ribosomes of a cell. The sequence of amino acids is controlled by RNA molecules present in the cytoplasm. The RNA in turn is controlled by the nucleotide bases which form a DNA strand within the nucleus.



By looking carefully at the diagram and following the arrows, answer the following questions:

1 What is the name given to a single strand of DNA coding for a gene?

..... [1]

2 How does this genetic information pass from the nucleus to the cytoplasm?

..... [1]

3 Where does the strand of genetic code attach for protein synthesis?

..... [1]

4 What is the name given to the small RNA molecules within the cytoplasm?

..... [1]

5 How many nucleotide bases are required for capturing an amino acid?

..... [1]

6 The small RNA molecules attach to the genetic strand from the nucleus through their nucleotide bases. During the process of protein synthesis, amino acids link up with each other while separating from the RNA molecules. Describe the steps and explain why this process takes place.

.....

.....

.....

..... [3]

Q3. Case study 1

In one experiment, a group of fifteen baby rats were divided into five groups of three. The five groups were fed on a diet of pure egg protein, glucose, starch, lard, and water. In addition, each group received a supplement of milk. The animals were allowed to grow for fifteen days and then they were weighed. The results of this experiment are shown below.

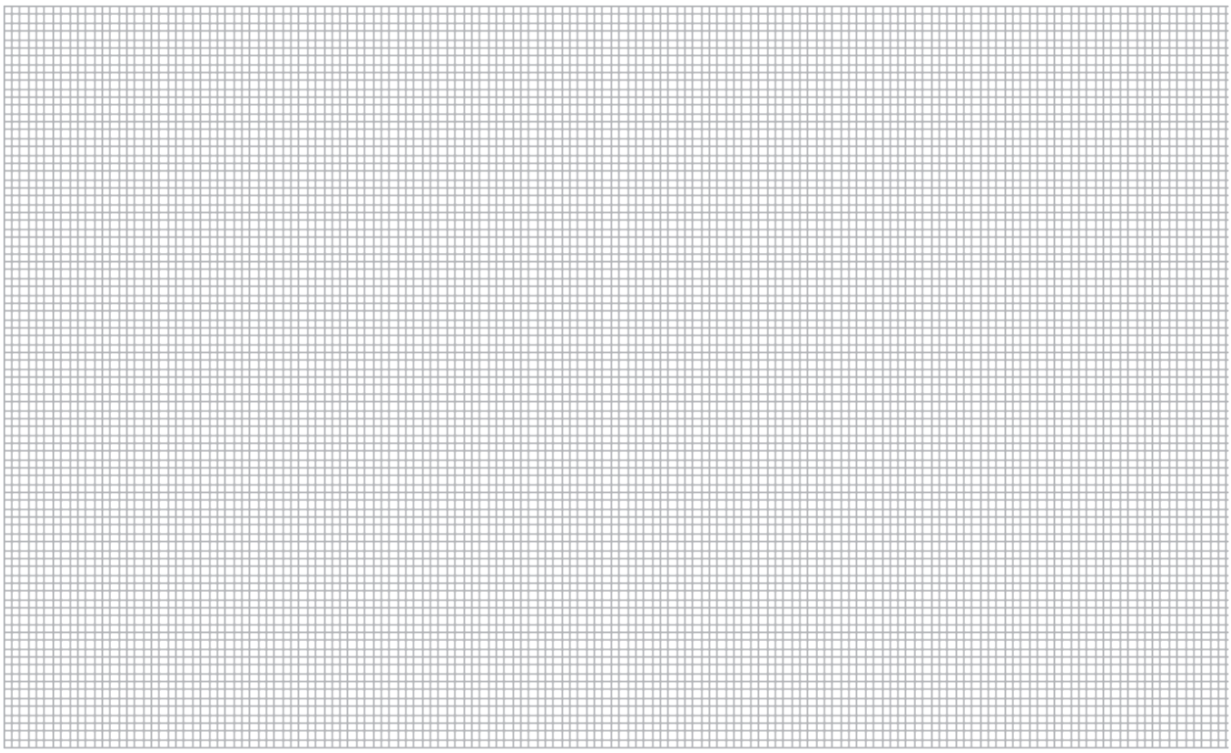
Amount of additional milk (cm^3)	Mass of animal at fifteen days: three values ( )	Mean (average) mass of animals ( )
5	45, 48, 42	
10	50, 53, 50	
15	53, 52, 54	
20	56, 57, 58	
25	60, 59, 64	

(a) Calculate the mean mass of each of the groups, and write your answers into the table. Add the correct units for mass. (Think carefully!)

(b) What is the input (**independent**) variable for this experiment?

(c) What is the outcome (**dependent**) variable?

(d) Plot the results as a line graph on the grid provided below. Include a title for your graph.



[4]

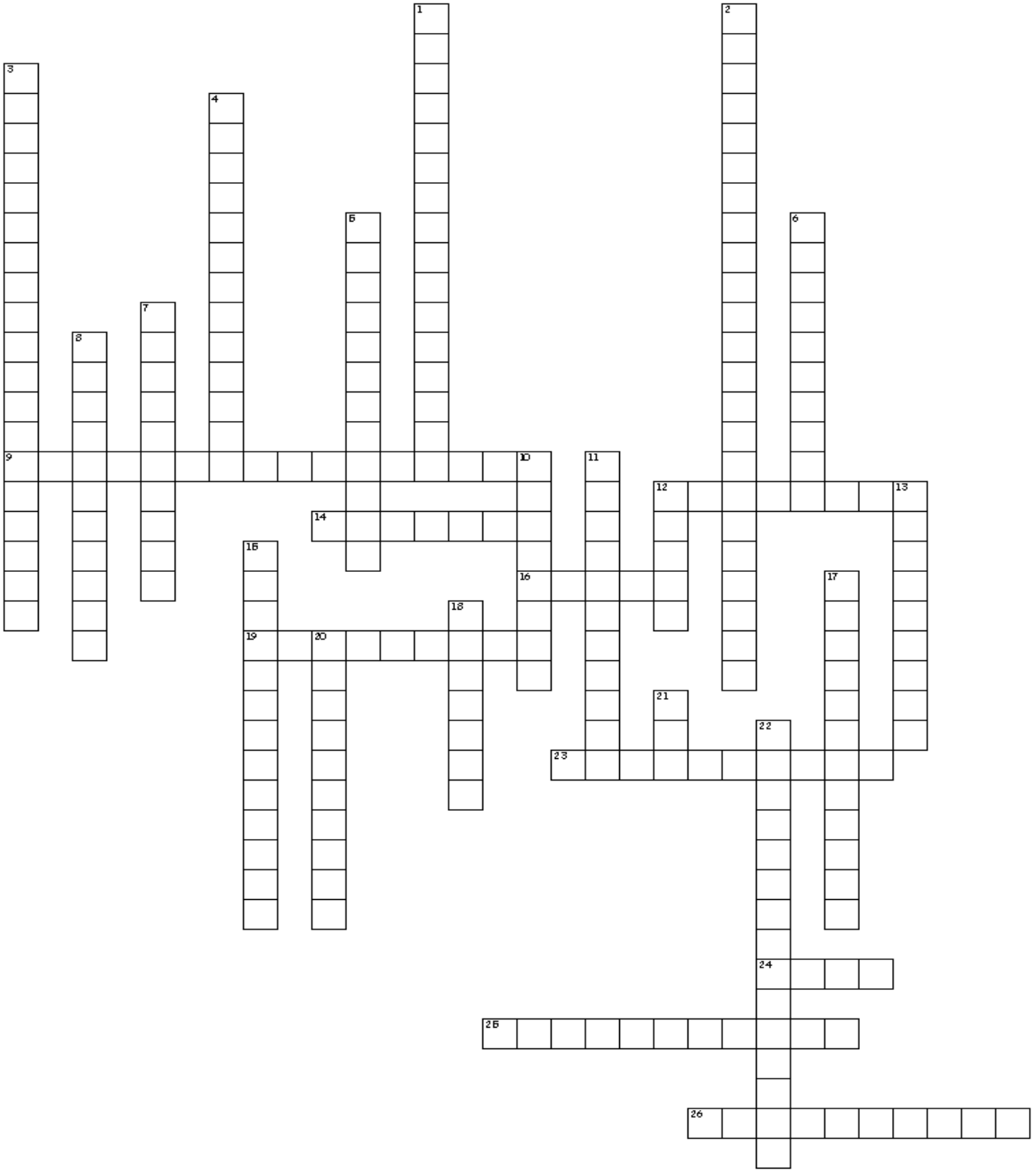
(e) Suggest three control variables for this experiment.

..... **[3]**

(f) What is present in the milk that might explain these results?

..... **[2]**

Human Impact on the Environment



Across

9. Rain or snow with an acid pH that makes soil and water on Earth more acidic

12. The effect CFC's have on our ozone layer

14. Ecological areas identified to be rich in biodiversity and are in much need of protection

16. O_3 gas in our atmosphere

19. The part of Earth where all living things are found

23. Habitat destruction cause this reduction in the size of some populations

24. Air pollution composed of water vapor and chemicals from human activities

25. All rivers, lakes, streams, oceans, rivers, and ponds on Earth

26. Protected wetlands in the southern United States that is rich in organisms

Down

1. Ability of the Earth's atmosphere to trap heat and keep us warm

2. The increase in concentration of some chemicals within organisms as you goes higher in a food chain

3. Chemicals once used as refrigerator coolants and aerosol can propellants affecting the Earth's ozone layer

4. Greenhouse gas that cycle by the processes of photosynthesis and cellular respiration

5. Scientists trying to identify, manage, and protect natural areas where many organisms live

6. The death of all members of a species of organisms

7. Mixture of gases that surrounds the Earth

8. Burning these increases the amount of carbon dioxide in the Earth's atmosphere

10. The main gas making up the Earth's atmosphere

11. Scientists trying to repair ecosystems that are badly damaged

12. percent of Earth covered with freshwater suitable for drinking

13. Earth's rock interior extending from the molten core to the crust

15. Increase in the average temperature of the Earth possibly due to an increase in the levels of carbon dioxide in the atmosphere

17. Variety of different types of organisms living in an area

18. percent of the Earth covered with water

20. Absorbs most of the sun's harmful, ultraviolet rays before they reach Earth

21. Molecule that is damaged by too much ultraviolet radiation

22. Group of organisms that are important to the life of many other types of organisms in an ecosystem

5. Sociology

Task 1.

a). Read the following topics:

- Education in social context
- Debates about the links between social inequality and educational opportunity and achievement

online/ from the Sociology for Cambridge International AS & A Level Course book.

b). Learn all the key terms related to the topic. (Take help from the Dictionary)

Task 2.

Reviewing Vocabulary

Complete each sentence using each term once.

a. open-classroom model **b. cooperative learning** **c. tracking** **d. meritocracy**
e. educational equality **f. multiculturalism** **g. hidden curriculum**
h. self-fulfilling prophecy

1. _____ is a prediction that results in behavior that makes the prediction comes true.
2. A non-bureaucratic classroom structure in which students' study in groups is called_____.
3. An educational curriculum that accents the viewpoints, experiences, and contributions of minorities is called_____.
4. _____ is equality defined in terms of the effects or results of schooling.
5. Placing students in curricula consistent with expectations for their eventual occupations is called_____.
6. _____ is social status based on achievement rather than social class or parental class.
7. _____ includes discipline, order, cooperation, and conformity.
8. _____ did away with the sharp authoritarian line between teacher and students.

Task 3. Short answers. (Search from Cambridge Endorsed book/ online)

1. How is education related to life expectancy?
2. What is social promotion? How can it be both functional and dysfunctional?

Task 4. Essay Questions:

1. Explain how the labels teachers attach to students are an important factor in determining educational success.
2. 'Those who shape the curriculum also determine which pupils will succeed and fail.' Assess this claim.
3. Assess the usefulness of new right theories in understanding educational inequality.

Task 5:

1. Sociological explanations recognize that most human behavior is learnt by individuals as members of society, rather than something with which they are born. Individuals learn how to behave from a wide range of social institutions and this continues throughout their lives. Sociologists use the term socialization to describe this process of learning. While not everyone in society will always behave in the same way, there are often strong pressures on people to conform to the most important values. Various sanctions and rewards exist to encourage social conformity.

(a)What is meant by the term social institution?

(b) Describe two sanctions that may be used to encourage social conformity.

(c) Explain why not everyone in society behaves in the same way.

(d) Assess the functionalist view that all members of society benefit from the existence of social order.

2. The relationship between formal education systems and the economy is both complex and multidimensional. This is partly because the structure and organization of education always reflects ideological beliefs about its meaning, purpose and relationship to other social institutions. This complexity is also due to the way in which economic systems of production, distribution and exchange have developed historically.

(a) Define the term formal education?
(b) Differentiate between grammar and secondary school education?
(c) Explain two ways how the institutions are connected according to the functionalists?
(d) Assess this relationship from neo-functionalism/new right perspective?

Recommended Books (Endorsed by Cambridge):

1. Sociology for Cambridge International AS & A Level Coursebook
Author: Livesey, C and Blundell, J
2. Sociology for Cambridge International AS & A Level Coursebook
Author: Chris Livesey

6. Psychology

Psychology and Consumer Behaviour

Consumer psychology: It is the study of human behavior regarding their buying patterns, customs and preferences in relation to consumer products, packing and marketing of those products.

The Physical Environment:

Retail/leisure environment design

Retail store architecture (Turley and Milliman, 2000)

Leisure environments (Finlay et al., 2006)

Store interior layout (Vrechopoulos,2004)

Evaluate these studies.

The Psychological Environment:

Personal space

Space at restaurant tables (Robson et al., 2011)

Defending place in a queue (Milgram et al., 1986)

Evaluate these studies.

Consumer Decision-Making

Intuitive Thinking

Choice blindness (Hall et al., 2010)

False advertising and memory (Braun-LaTour et al., 2004)

Evaluate these studies.

Advertising:

Marketing mix models: The 4 Ps (McCarthy), The 4 Cs (Lauterborn)

Product placement in films (Auty and Lewis, 2004)

Evaluate these studies.

Question:

(a) Studies of retail/leisure design environments have not helped psychologists understand buyer behavior.'

(b) To what extent do you agree with this statement? Use examples of research you have studied to support your answer.

Psychology and Organizations

Organizational Psychology: It is the branch of psychology that applies psychological theories and principles to organizations. It focuses on increasing workplace productivity and related issues such as the physical and mental wellbeing of employees.

Need Theories:

Hierarchy of Needs (Maslow, 1970)

ERG Theory (Alderfer, 1972)

Achievement Motivation (McClelland, 1965)

Evaluate these studies.

Cognitive Theories:

Goal-setting theory (Latham and Locke, 1984)

VIE (expectancy) theory (Vroom, 1964)

Equity theory (Adams, 1963)

Evaluate these studies.

Leaders and followers:

Leader-Member Exchange Model (Dansereau, 1994) and

Individualised Leadership Model (Dansereau, 1995)

Followership: Qualities and Types (Kelley, 1988)

Measuring Leadership: Leadership Practices Inventory (Kouzes and Posner, 1987)

Evaluate these studies.

Theories of Job Satisfaction:

Two Factor Theory (Herzberg, 1959)

Job Characteristics Theory (Hackman and Oldham, 1976)

Evaluate these studies.

Questions:

(a) Design a study to investigate worker preference for job rotation or job enrichment.

(b) Explain the psychological and the methodological evidences on which your study is based**.**

Read through the description of the study and answer the questions that follow.

Author (date): Bandura (1961)

Aim

Bandura (1961) conducted a controlled experiment study to investigate if social behaviors (i.e., aggression) can be acquired by observation and imitation.

Sample

Bandura, Ross, and Ross (1961) tested 36 boys and 36 girls from the Stanford University Nursery School aged between 3 to 6 years old.

The researchers pre-tested the children for how aggressive they were by observing the children in the nursery and judged their aggressive behavior on four 5-point rating scales.

It was then possible to match the children in each group so that they had similar levels of aggression in their everyday behavior. The experiment is, therefore, an example of a matched pairs design.

To test the inter-rater reliability of the observers, 51 of the children were rated by two observers independently and their ratings compared. These ratings showed a very high reliability correlation ($r = 0.89$), which suggested that the observers had a good agreement about the behavior of the children.

Method/Procedure

A lab experiment was used, in which the independent variable (the type of model) was manipulated in three conditions:

- Aggressive model is shown to 24 children
- Non-aggressive model is shown to 24 children
- No model shown (control condition) - 24 children

Stage 1: Modeling

In the experimental conditions children were individually shown into a room containing toys and played with some potato prints and pictures in a corner for 10 minutes while either:

1. 24 children (12 boys and 12 girls) watched a male or female model behaving aggressively towards a toy called a 'Bobo doll'. The adults attacked the Bobo doll in a distinctive manner - they used a hammer in some cases, and in others threw the doll in the air and shouted "Pow, Boom."
2. Another 24 children (12 boys and 12 girls) were exposed to a non-aggressive model who played in a quiet and subdued manner for 10 minutes (playing with a tinker toy set and ignoring the bobo-doll).
3. The final 24 children (12 boys and 12 girls) were used as a control group and not exposed to any model at all.

Stage 2: Aggression Arousal

All the children (including the control group) were subjected to 'mild aggression arousal.' Each child was (separately) taken to a room with relatively attractive toys.

As soon as the child started to play with the toys, the experimenter told the child that these were the experimenter's very best toys and she had decided to reserve them for the other children.

Stage 3: Test for Delayed Imitation

• The next room contained some aggressive toys and some non-aggressive toys. The non-aggressive toys included a tea set, crayons, three bears and plastic farm animals. The aggressive toys included a mallet and peg board, dart guns, and a 3 foot Bobo doll.

• The child was in the room for 20 minutes, and their behavior was observed and rated though a one-way mirror. Observations were made at 5-second intervals, therefore, giving 240 response units for each child.

• Other behaviors that didn't imitate that of the model were also recorded e.g., punching the Bobo doll on the nose

Results

• Children who observed the aggressive model made far more imitative aggressive responses than those who were in the non-aggressive or control groups.

• There was more partial and non-imitative aggression among those children who had observed aggressive behavior, although the difference for non-imitative aggression was small.

• The girls in the aggressive model condition also showed more physical aggressive responses if the model was male, but more verbal aggressive responses if the model was female. However, the exception to this general pattern was the observation of how often they punched Bobo, and in this case the effects of gender were reversed.

• Boys were more likely to imitate same-sex models than girls. The evidence for girls imitating same-sex models is not strong.

• Boys imitated more physically aggressive acts than girls. There was little difference in the verbal aggression between boys and girls.

Conclusion

The findings support Bandura's (1977) Social Learning Theory. That is, children learn social behavior such as aggression through the process of observation learning - through watching the behavior of another person.

This study has important implications for the effects of media violence on children.

Evaluation

There are three main **advantages** of the experimental method.

1. Experiments are the only means by which cause and effect can be established. Thus, it could be demonstrated that the model did have an effect on the child's subsequent behavior because all variables other than the independent variable are controlled.

2. It allows for precise control of variables. Many variables were controlled, such as the gender of the model, the time the children observed the model, the behavior of the model and so on.

3. Experiments can be replicated. Standardized procedures and instructions were used, allowing for replicability. In fact, the study has been replicated with slight changes, such as using video and similar results were found (Bandura, 1963).

Limitations of the procedure include:

- Many psychologists are very critical of laboratory studies of imitation - in particular because they tend to have low ecological validity. The situation involves the child and an adult model, which is a very limited social situation and there is no interaction between the child and the model at any point; certainly the child has no

chance to influence the model in any way. Also, the model and the child are strangers. This, of course, is quite unlike 'normal' modeling, which often takes place within the family.

- Cumberbatch (1990) found that children who had not played with a Bobo Doll before were five times as likely to imitate the aggressive behavior than those who were familiar with it; he claims that the novelty value of the doll makes it more likely that children will imitate the behavior.
- A further criticism of the study is that the demonstrations are measured almost immediately. With such snap shot studies, we cannot discover if such a single exposure can have long-term effects.
- It is possible to argue that the experiment was unethical. For example, there is the problem of whether or not the children suffered any long-term consequences as a result of the study. Although it is unlikely, we can never be certain.

Source: Simply Psychology, https://www.simplypsychology.org/bobo-doll.html

1. Summarise Bandura (161) in 3-4 paragraphs.
2. Identify the research method used?
3. Identify three ethical considerations of this study.
4. To what extent can this study's conclusions be applied to people in general?
5. This study gave rise to the theory of Social Learning, that children learn by observation. To what extent does this study support the claim that children learn by observing others?

7. Business Studies

Enterprise

Word match

1. Match each word from the first column with a word from the second column to give the characteristics of an entrepreneur.

Opportunity	Taker
Risk	Motivator
Decision	Spotter
Creative	Communicator
Self	Thinker
strong	Maker

2. Added Value

1 For a cup of tea identify:

a The inputs ----------

b The process ----------

c The output ----------

2 How much would you be willing to pay? ----------

3 What is the estimated added value?----------

4 Consider each of the images on the next page:

a How have the inputs changed? ----------

b How has the process changed? ----------

c How has the output changed? ----------

5 Does this affect the price you are willing to pay? ----------

6 Does this affect the added value? ----------

Business Stakeholders

Identify whether each of the following statements is true or false.

Statement	True / False
The term stakeholder includes shareholders	
Businesses do not regard pressure groups as stakeholders	
The national government of a country is a stakeholder of businesses	
All stakeholders will have an objective of profit maximization	
Conflicts may occur between stakeholders needs	
Stakeholders are part owners of a business	
Stakeholder actions can influence business objectives	
Shareholders can receive a share in a company`s profits	
Only incorporated businesses have stakeholders	
All stakeholders will want businesses to behave in a socially responsible manner	
Corporate social responsibility means a business considers the interests of society	
A business that meets all the legal requirements is behaving in a socially responsible way	
Shareholders are the most important stakeholders in a business	

Business Size

1. Match each method of measuring the size of a business to the correct explanation. Match each method of measuring the size of a business to the correct explanation.

Measurement
Number of employees
Market capitalization
Market Share
Capital employed
Sales turnover

Explanation
Total of a company`s issue shares
Total value of sales in a given period of time
The value of long term finance
The total size of work force
Sales of the businesses as a percentage of capital employed

2. Blackberry Ltd has sales of £0.6 million. The market is worth £12 million. Calculate the market share of Blackberry Ltd.
3. Netherton Plc has 12.5% of a market worth £62 million. Calculate the sales value of Netherton Plc.
4. A seaside town has three fish and chip shops/cafés: F&C with annual sales of £156,000; The Chippie with annual sales of £240,000; and Carla's Café with annual sales of £104,000. Calculate the market share of The Chippie.
5. Which **one** of the following is an example of internal growth?

   a). An airline buys another airline

   b). A fashion retailer opens two new stores

   c). A manufacturing company relocates abroad

   d). A family business introduces a new member of the family to the business

Market research

Across

5 Research collected first-hand

8 Mintel and Key Note are examples of organisations that specialise in this field

9 May affect accuracy

10 Sampling where everyone has an equal chance of being included

12 Asking 25% of women aged 18–21 and 75% aged 22–30

Down

1 An icy game with friends

2 A government publication showing demographic breakdown of a country

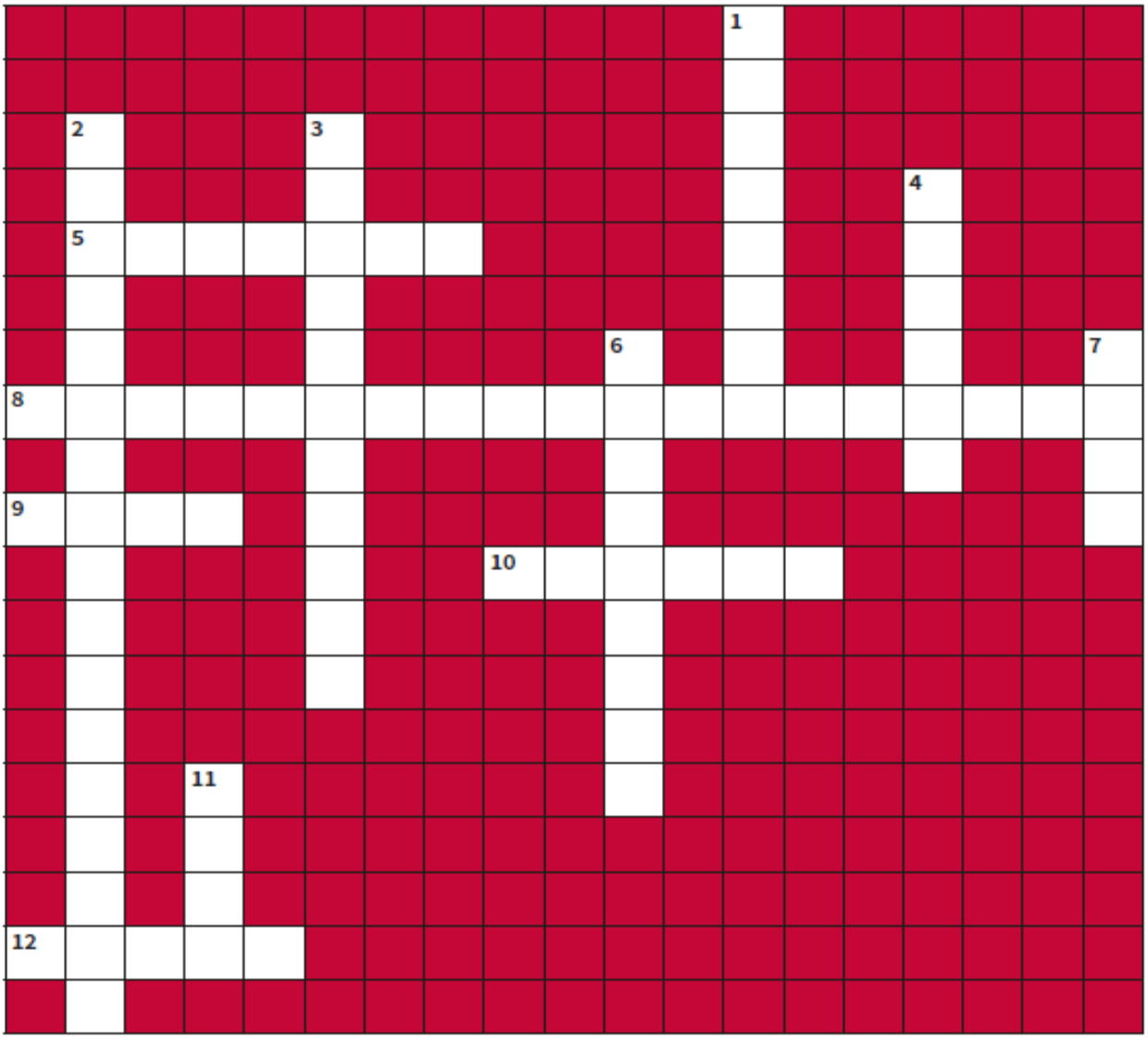
3 Non-statistical

4 The answer is 'yes' or 'no'

6 Research that already exists

7 Not too kind on average

11 Marketing to trial section of population



The marketing mix – product and price

True or false?

1 Which **one** of the following statements is true?

a An inelastic demand curve has a shallower gradient than an elastic one.
b A product with a high PED should put prices up to increase sales revenue.
c A rise in price will lead to a more than proportional fall in demand for an elastic product.
d A fall in price will have no effect on demand for an inelastic product.

2 Which **two** of the following statements are true?

a If a product has a unitary PED a change in price will not affect sales revenue.
b If a product has a PED of 1.2 an increase in price will lead to a more than proportional increase in demand.
c The greater the number of substitutes available the lower the elasticity of a product.
d A perfectly elastic demand curve is horizontal.

Marketing mix questions

1 Match each of the 4Ps of the marketing mix to the 4Cs – the role of the customer.

4Ps
Product
Place
Price
Promotion

4Cs
Cost to the customer
Customer solution
Communication
Convenience

2. Firm A has a PED of 1.4. It currently sells 10,000 units at a price of $6 per unit. The marketing manager has suggested raising the selling price by 5%.
a What will happen to sales revenue? Will it move up or down?
b What was the sales revenue?
c Carry out a calculation to show the new sales revenue.

Human resource management

HRM questions

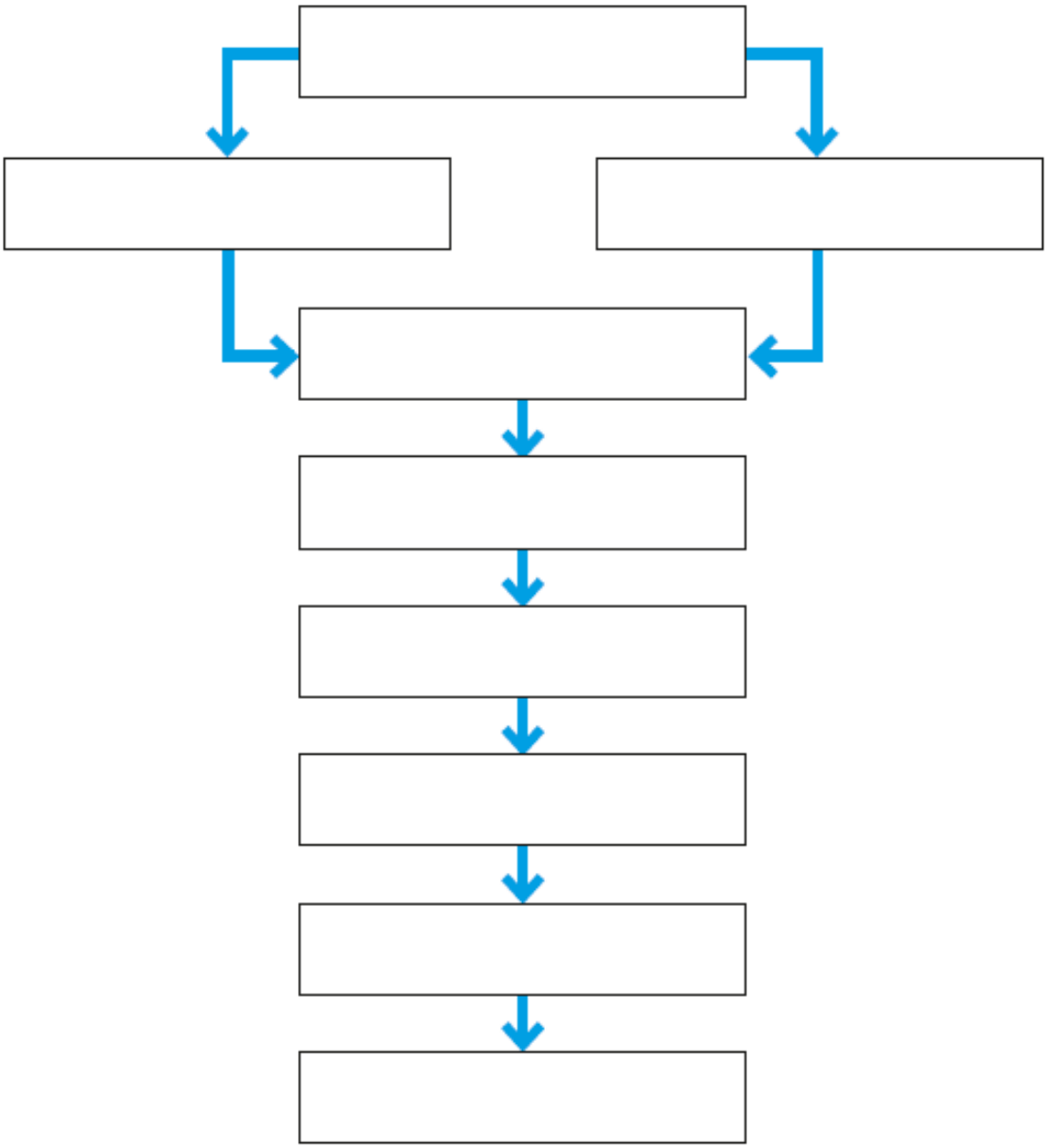
1 How would you summarise into fewer than 15 words the role of the HR department in a firm?

2 Why is the HR department's work central to the success of other functional areas, i.e., marketing, finance and operations management?

Complete the diagram

Use the terms shown below to complete the diagram to show the stages in the recruitment and selection process.

Shortlist	Job description	Job advert
Employment contract	Select successful candidate	Identify vacancy
Induction training	Interviews	Person specification



8. Accounting

Assignment no.1

Chand Restaurant

Chand Restaurant has a good local reputation for first-class meals at first-class prices. It has a weekly capacity for 1,000 customers. It has a loyal customer base, but the manager, Mustafa, is concerned about the disappointing number of new customers. Total revenue has fallen over the past few months and Mustafa believes that this is partly due to the closure of the local head office of an insurance company. Job losses occurred at all levels of the organization, especially among middle managers. Mustfa is considering introducing a new menu that would offer less variety and less-complicated dishes. He thinks that the new items on the menu would be cheaper to produce and he would not have to replace one of the skilled chefs, who have just given in his notice to leave. Mustafa estimates that the number of customers could increase by 20% per night on average as he had noticed that a recently opened medium-price café/bar was full every night. Mustafa has shown the following financial data to the restaurant's accountant, who started to do some calculations. 'I need to calculate the break-even level of output and the margin of safety.

Current menu option:

Revenue per week (600 customers @ average of $20) $12,000

Average variable cost per meal $5

Overhead costs per week (including salaries of kitchen staff) $7,000

Proposed new menu:

Average meal price $14

Average variable cost per meal $4

Overheads per week (including salaries of kitchen staff) $6,000

1 a Define the term 'break-even level of output'.

b Briefly explain the term 'margin of safety'.

2 Calculate the forecast average monthly profit figures for the two menu options.

3 Calculate the:

a break-even level of output of both options

b margin of safety for both options

4 Would you advise Mustafa to adopt the new menu ? Justify your answer.

Assignment no.2

A Social Club had the following assets and liabilities at 1 April 2018.

	$
Non-current assets	14 500
Bank overdraft	3 600
Trade payables	2 250
Accrued electricity expenses	1 550
Prepaid insurance	300
Inventory	2 200
Subscriptions in arrears	150
Subscriptions in advance	100

Required

(a) Explain what is mean by the term accumulated fund?

(b) Calculate the accumulated fund at 1 April 2018.

Additional information

The annual subscription has been unchanged for the past few years. During the year ended 31 March 2019, a total of $13 900 was received from 278 members who paid their annual subscription in full. One member, who owed the club for the previous year's subscription, was unable to pay and this amount was written off.

At 31 March 2019, six members had not paid their annual subscription and one member had paid the following year's subscription in advance.

(c) Prepare the subscriptions account for the year ended 31 March 2019.

(d) Prepare an extract from the statement of financial position at 31 March 2019 to show how the balances on the subscriptions account are recorded.

Assignment no.3

Nibali has provided the following information for the year ended 31 July 2019.

	$
Closing inventory	50 000
Opening inventory	30 000
Revenue	750 000
Trade receivables	65 000
Trade payables	31 850

Cash sales are 10% of total revenue.

Cash purchases are 25% of total purchases.

Gross margin is 20%.

Nibali's standard credit terms with both customers and suppliers are 30 days.

Industry average inventory turnover is 15 days.

REQUIRED

(a) With the help of formulas calculate:

(i) inventory turnover in days

(ii) trade receivables turnover in days.

(iii) trade payables turnover in days.

(b) Discuss the liquidity of Nibali's business based on the available information.

(c) Identify **three** drawbacks for a business of holding too much inventory

Assignment no.4

The following information was provided by the Kapoor Manufacturing Company on 30th April 2019.

Raw Materials: - Stock 1st May 2018	$14900
Stock 30th April 2019	$15300
Purchases	$181200
Carriage on purchases	$3300
Work in Progress: - At 1st May 2018	$8790
At 30th April 2019	$8640
Factory Wages: - Direct	$166100
Indirect	$93800
Royalties	$10000
Factory Insurance	$2070
Factory Rent and Rates	$2930
Factory general expenses	$6350
Depreciation of factory machinery	$9500

The total Production of the Company in a year is 20000 articles. Factory profit is 25%

Required:

(a) Prepare the Manufacturing account of this company.

(b) Calculation of an article cost in this year.

(c) Mr. Kapoor wants to increase his production in the next year, state which cost will not increase due to increase in production.

(d) Explain the difference between direct costs and indirect costs.

Assignment no.5

How is my business doing?

Mohammed Ahmed is the chief executive of Ahmed Builders plc. The company specialises in the quality fitting out of shops for internationally famous retailers. These customers demand that work is finished to very tight time limits, so it is important for Ahmed Builders to keep stocks of important materials. Mohammed is keen to compare the performance and liquidity of his company with that of another building company that does similar work. He obtained a set of published accounts for Flash Builders plc and used ratios to help him in the comparison. These were the figures he used from both companies.

(All figs $000)	Ahmed	Flash
Gross profit (213)	100	150
Operating profit (2013)	20	60
Revenue (2013)	350	600
Current assets (as at 31/12/13)	100	150
Inventories (as at 31/12/13)	50	60
Current liabilities (as at 31/12/13)	45	120

Required:

1 Calculate **two** profit margin ratios for both companies.

2 Comment on the profitability of both businesses. Should Ahmed be pleased about the performance of his business compared to Flash builders?

3 Explain and evaluate **two** ways in which Ahmed might attempt to increase the operating profit margin ratio for his business.

4 Calculate two liquidity ratios for both businesses. Show all working.

5 Comment on your results.

6 Explain and evaluate **two** ways in which Flash Builders plc might be able to improve its liquidity position.

9. Economics

Activity 1

New York: the city that still roars

According to a recent survey, residents of New York are less bothered about climate change than they are about noise levels. No wonder that this is the city that never sleeps.
Noise is the number one quality of life complaint of New Yorkers. One has only to go there as a visitor to be aware of screeching subway trains, honking cars and monster trucks, roaring planes from the three airports, barking dogs, and, finally, boisterous people. Other more localised sources of noise are the horse-drawn carriages in Midtown and the endless stream of tourist helicopters that buzz around Long Island and Manhattan.
In 2013, there were more than 300,000 calls to the city's 311 complaint hotline set up by Mayor Bloomberg some time ago. This was despite a tough noise code that required all construction sites to post noise mitigation plans; laws had also been passed to reduce noise from restaurants, sidewalks, and even garbage trucks. City officials have powers to issue instant fines where noise levels exceed the maximum permitted.
Despite thousands of violation notices, noise levels for many residents exceed the 85-decibel level, one that can cause hearing damage with prolonged exposure. Some residents close to the airports have to put up with noise levels that frequently exceed 100 decibels while tourists in Times Square can do little more than have a good look at what there is around them.
Pleas for peace and quiet don't exactly fall on deaf ears but despite these, the city still roars.
Source: Adapted from *China Daily*, 28 July 2013 and Huffington Post, 19 January 2014.

1 Explain why high noise levels are a form of market failure.

2 Give examples of negative externalities, explaining why this is so.

3 How in principle do regulations seek to reduce noise levels?

4 Discuss what other ways might be used to reduce noise levels.

Activity 2

Long-Run Aggregate Supply and Short-Run Aggregate Supply: Which Curve Shifts?

In the real world, change is typical. In our aggregate demand–aggregate supply model, change means that the curves shift. Careful application of the model requires that you be able to determine which curve shifts, and in which direction, when real-world events occur.

In each of the scenarios listed below, is there a shift in the long-run aggregate supply curve, the short-run aggregate supply curve, both, or neither? Explain your answer each time.

1. New shale gas deposits are found in North Dakota.
2. Hot weather leads to lower crop yields in the Midwest.
3. The Organization of Petroleum Exporting Countries (OPEC) meets and agrees to increase world oil output, leading to lower oil prices for six months.
4. U.S. consumers expect greater income in 2014.

Activity 3

Supply Side versus Demand Side: The Bush Tax Cuts

In mid-2001, the Bush administration won congressional approval for lower income tax rates. One stipulation of this rate cut was that the rates also be applied retroactively to taxes from the year 2000.

Would you consider this fiscal policy to be demand-side focused, supply-side focused, or both? Explain your response.

Activity 4

Expansionary versus Contractionary Monetary Policy: Monetary Policy in the Short Run

1. In the short run, how does expansionary monetary policy affect real GDP, unemployment, and the price level in the economy?

2. In the short run, how does contractionary monetary policy affect real GDP, unemployment, and the price level in the economy?
3. What real-world circumstance might lead to contractionary monetary policy?

Activity 5

Monetary Policy Isn't Always Effective: Why Couldn't Monetary Policy Pull Us Out of the Great Recession?

The Great Recession officially lasted from December 2007 to June 2009. But the effects lingered on for several years thereafter, with the slow growth of real GDP and high unemployment rates. This all occurred despite several doses of expansionary monetary policy. Not only did the Fed push short-term interest rates to nearly 0%, but it also engaged in several rounds of quantitative easing, in which it purchased hundreds of billions of dollars' worth of long-term bonds.

What are three possible reasons why the monetary policy was not able to restore expansionary growth during and after the Great Recession?

Activity 6

East Coast Rail returns to private hands

In March 2015, the *Guardian* newspaper reported that train services on the mainline between London and Edinburgh were once again being operated by a private firm after more than five years under state control, reigniting the row over ownership of the railway.

East Coast trains have been rebranded as Virgin Trains East Coast. Under the management of a joint venture between two private sector companies, Stagecoach and Sir Richard Branson's Virgin, a private sector organisation has taken over the running of the railway on an 8-year franchise.

The previous private operators of the east coast railway line 'failed to meet their financial commitments. A small government-owned company and Directly Operat1ed Railways stepped in to run trains on the mainline in late 2009 after the Last franchisee. National Express, walked away when revenues fell during the financial crisis.

In its 5 years as East Coast, the state-run firm gave several millions of pounds in profits to the Treasury. In the last 2 years in which it operated, East Coast was one of two state-owned firms to make a net contribution to government coffers, paying in more to the government than it received in subsidy or indirect grants.
The success of the nationalised East Coast trains led to calls to keep the line in state hands. The TUC general secretary, Frances O' Grady, said the sale to the private sector would be a 'costly mistake'. She said: 'By taking East Coast out of public ownership the government is passing the profits to Stagecoach and Virgin shareholders, instead of using the cash to reduce rail fares and improve services for passengers.

1. Do you agree that the publicly owned East Coast trains should still operate the east coast railway service? Justify your answer.
2. Explain the possible advantages and disadvantages of Privatisation.
3. Explain the difference between deregulation and regulation.

Activity 7

Officials in Shanghai are encouraging couples to have two children. This is a reversal of China's traditional one-child policy, which was introduced in the late 1970s in a bid to reduce the country's rapid population growth. It has been estimated that China's population would have been 1.7 billion rather than 1.3 billion if the policy had not been introduced.
Shanghai's change of policy has been prompted by a gender imbalance and by fears that the younger generation will not be able to support the ageing population. Currently, Shanghai's over-60 population exceeds 21% of the city's residents and the proportion is expected to rise to 34% by 2020.
Demographers are predicting that China's working population will start to shrink by 2015, the overall population will peak in 2030, and China will become the first country to grow old before it has grown rich and able to support a high proportion of pensioners.
In practice, predictions of population changes are relatively unreliable and it is difficult to judge whether a country is at, above, or below the optimum level.
The table below shows the birth and death rates for five countries in 2013.

The country Birth rate Death rate

Country	Birth rate	Death rate
Brazil	15.0	6.4
China	11.9	7.5
Indonesia	17.4	6.8
Kenya	36.9	9.9
Lativa	10	13.8

Birth and death rates for five countries

1. Define the 'optimum population'
2. Using the table, identify a country experiencing a natural decrease in population size and explain your answer.
3. Comment on whether it can be concluded that Kenya had a faster increase in population in 2013 than Indonesia.

4. Explain the two disadvantages of rapid population growth.
5. Discuss whether China will struggle to support its pens.

10. Law

1. Read the extract from the following Judgment and answer the questions given at the end.

Keown V Coventry Health Care Trust

A man who claimed that brain damage turned him into an offender had only himself to blame for the childhood accident which caused his condition, The Court of Appeal ruled.

Martyn Keown was only 12 when he fell 30 feet from the underside of an external fire escape at Gulson Hospital in Coventry in 1995.

He broke his arm and suffered severe brain damage which caused a loss of intellectual function and a personality change which allegedly caused him to be subsequently convicted of various criminal offences. When his damages action was brought against Coventry Healthcare Trust in May last year,he was brought from prison to give evidence.

He told Mr Recorder at the hearing that he knew he should not be climbing the fire escape as it was dangerous but he was showing off to his younger Sister and a friend.

The Court found that the Trust was in breach of duty to Mr Keown under the Occupiers Liability Act 1984, but reduced any damages by two thirds because of his contributory negligence. Allowing the Trust's appeal against the one third finding of liability,Lord Justice Longmore said that it would be a great disappointment to Mr Keown, who had suffered a severe injury.But the Recorder's decision could not be justified under the terms of the 1984 Act. Mr Justice Lewison said that if the recorder was right, occupiers of buildings up and down the country would have to child-proof their buildings in case children tried to climb them. For Mr Keown to succeed it had to be shown that the premises were inherently dangerous and there was nothing inherently dangerous about the fire escape.

There was no physical defect in it, no element of disrepair or structural deficiency; nor was there any hidden danger. The only danger arose from the activity of Mr Keown in choosing to climb up the outside knowing it was dangerous to do so.

Questions

1. What harm had Keown suffered because of the alleged poor state of the premises?
2. What was the legal argument that he used to support his claim?
3. What duty of care is owed to Keown?
4. Why was Keown considered to be contributory negligent in the County Court
5. What were the two reasons why the court decided against Keown?
6. What policy reasons were included in the decision?

2. Acceptance of an offer must be communicated before a contract comes into existence. Critically assess any exceptions to this principle that might exist.
3. Neelam asks her next door neighbour, Rohan,if he will give her a lift to the airport. Rohan readily agrees. Once at the airport, Neelam says she will give him a present when she returns home. Is Neelum legally bound to provide a present?
4. Injustice is caused by the rules relating to the capacity of minors to contract with adults.
   Critically assess the remedies available to the adult.
5. Compare the role of Juries and Lay Magistrates in the administration of Justice.

11. Computer Science

Assignment 1

On a data entry form user is asked to input 15 letters NIC according to following format:

99999-AAAAAAA-9

Where, letter "9" indicates a digit and "A" indicates an alphabet. The "-" must be present at correct location, i.e. the 6th and 14th character in the string.

1. Write a Boolean valued function to receive NIC from calling program and return "TRUE" if NIC is following above format otherwise return "FALSE".

Your code may use any of following string handling functions:

```
MID(ThisString : STRING, x : INTEGER, y : INTEGER) RETURNS STRING
```
returns string of length `y` starting at position `x` from `ThisString`.
Example: **`MID("ABCDEFGH", 2, 3)`** returns string **`"BCD"`**

```
LEFT(ThisString : STRING, x : INTEGER) RETURNS STRING
```
returns leftmost `x` characters from `ThisString`.
Example: **`LEFT("ABCDEFGH", 3)`** returns string **`"ABC"`**

```
RIGHT(ThisString: STRING, x : INTEGER) RETURNS STRING
```
returns rightmost `x` characters from `ThisString`.
Example: **`RIGHT("ABCDEFGH", 3)`** returns string **`"FGH"`**

```
LENGTH(ThisString : STRING) RETURNS INTEGER
```
returns the integer value representing the length of string `ThisString`.
Example: **`LENGTH("Happy Days")`** returns **`10`**

2. Discuss the advantages of modular programming using both built-in and user-defined functions.
3. Write down program code for your pseudocode in Q 1.

Assignment 2

4. To download a file on computer network , BitTorrent protocol is widely used now a days.
5. Name and Describe the Network model used in such an application.
6. Describe the necessary steps how BitTorrent Protocol download a file.
7. For the BitTorrent protocol, explain the function of each of the following:

(i) Tracker

(ii) Seed

(iii) Swarm

(iv). Leecher:

Assignment 3

CPU scheduling is a process which allows one process to use the CPU while the execution of another process is on hold (in waiting state) due to unavailability of any resource like I/O etc. thereby making full use of CPU. The aim of CPU scheduling is to make the system efficient, fast and fair. Operating system normally uses the following Scheduling algorithms:

- First-Come, First-Served (FCFS) Scheduling.
- Shortest-Job-Next (SJN) Scheduling.
- Priority Scheduling
- Shortest Remaining Time.
- Round Robin(RR) Scheduling.
- Multiple-Level Queues Scheduling.

1. Discuss each of the above scheduling algorithms in terms of relative advantages and disadvantages.
2. Differentiate between preemptive and non-preemptive scheduling.

Assignment 4

The array ItemList[1:20] stores data. A **bubble sort** sorts these data.

1. Complete the following algorithm for bubble sort:

```
01    MaxIndex ← 20
02    NumberItems ← ……
03    For Outer ← 1 To ……
04        FOR Inner ← 1 To NumberItems
05        IF ItemList[Inner]  > ……
06        THEN
07            Temp ← ItemList [……..]
08            ItemList[Inner] ← ItemList [……]
09            ItemList[Inner + 1 ] ← …….
10        ENDIF
11    ENDFOR
```

12 NumberItems ← ……..

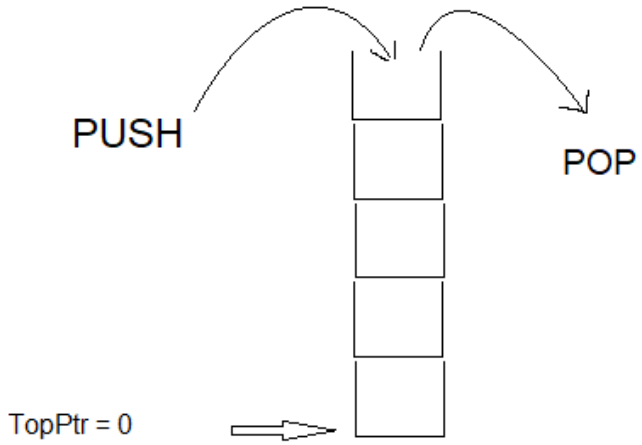
13 ENDFOR

2 The above algorithm is inefficient. Explain why?

3. Explain how would you improve the efficiency of this algorithm. Re-write the improved version.

Assignment 5

Stack is an ADT in which insertion (PUSH) and deletion (POP) is possible only from one end. TopPtr is stack pointer used to keep track of current position of stack.

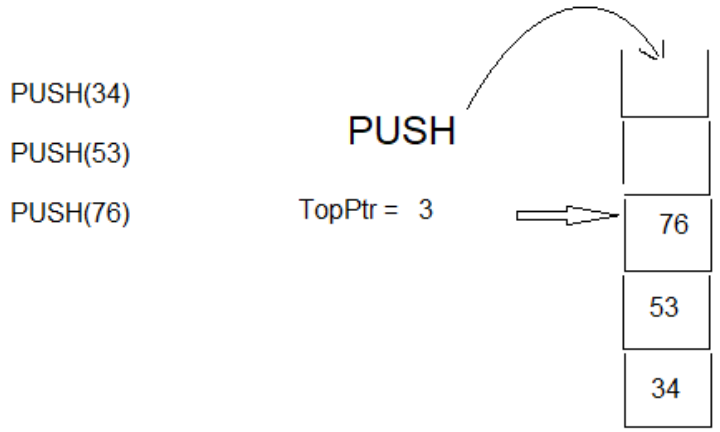


PUSH( ) is a procedure used to insert a new data item at current stack position.'

POP ( ) is a function used to delete top most data item from stack.

Initially TopPtr = 0 which indicates that stack is empty.

Stack position after 3 insertions / PUSH will be:



Stack position after 2 POPs is:

TASK 1:

Write down Procedure PUSH() and Function POP( ) to simulate the functionality of a Stack implemented into a 1-D Array STACK with upper bound stored into an identifier MAXSIZE.

Your code must include appropriate messages for “Empty Stack” and “Stack Overflow”

12. Critical Thinking

Thinking critically means to question new information before accepting it as true. If you are told something new or read something new, here are some questions that you can ask before accepting the new information as true…

What: -is the source of the information and is it a reputable and reliable source?
- are some alternative explanations/perspectives?

Who: -benefits (or could benefit) from this information?
-else have you heard discuss this?
-is this harmful to?
-would be best to ask for more information about this topic?
-is the person generating this information and what is their expertise in the matter?

Where: -could we search for supporting information or information to refute the information?
-are similar concepts/information available?
-has this information come from to you?

When: -was this information created?
-was the information received (compared to when it was created)?

Why: -is the information relevant to you/others?
-has the information been created and communicated?
-are people influenced by this information?
-is this information needed now?

How: -is this information similar to other information?
-can this information be used?

Read the following 3 news article and apply some critical thinking questions to answer the basic question: should I believe this new information? Which articles do you think are true, not true, not sure and would want more information before deciding? Does the source (where you receive information from) matter in your critical thinking?

Article 1:

The first Arab space mission to Mars has blasted off aboard a rocket from Japan, with its unmanned probe – called Al-Amal, or Hope – successfully separating about an hour after liftoff.

A live feed of the launch showed the rocket carrying the probe lifting off from the Tanegashima Space Centre in southern Japan at 6.58am (9.58pm GMT).

Almost exactly one hour later, the feed showed people applauding in the Japanese control room as the probe successfully detached.

In Dubai, the launch was met with rapturous excitement, with the UAE Mars mission's deputy project manager Sarah al-Amiri declaring it "an indescribable feeling" to see the probe blasting off.

"This is the future of the UAE," Amiri, who is also minister of state for advanced sciences, told Dubai TV from the launch site.

The Emirati project is one of three racing to Mars, including Tianwen-1 from China and Mars 2020 from the United States, taking advantage of a period when the Earth and Mars are nearest.

In October, Mars will be a comparatively short 38.6m miles (62m km) from Earth, according to Nasa.

Hope is expected to reach Mars's orbit by February 2021, marking the 50th anniversary of the unification of the UAE, an alliance of seven emirates.

Unlike the two other Mars ventures scheduled for this year, it will not land on the planet, but instead orbit it for a whole Martian year, or 687 days.

While the objective of the Mars mission is to provide a comprehensive image of the weather dynamics in the red planet's atmosphere, the probe is a foundation for a much bigger goal – building a human settlement on Mars within the next 100 years.

The UAE also wants the project to serve as a source of inspiration for Arab youth, in a region too often wracked by sectarian conflicts and economic crises.

On Twitter, the UAE's government declared the probe launch a "message of pride, hope and peace to the Arab region, in which we renew the golden age of Arab and Islamic discoveries."

Source: The Guardian (July 20, 2020), https://www.theguardian.com/science/2020/jul/20/uae-mission-mars-al-amal-hope-space

Article 2:

A couple living on the South Island's Otago Peninsula in New Zealand are not giving up hope of finding their beloved dogs – despite having spent $20,000 (£10,400) and nine months scouring the country for them, to no avail.

Nine-year-old black poodle Dice and three-year-old fox terrier Weed went missing from Alan Funnell and Louisa Andrew's home in October last year.

Since then, Funnell has spent one weekend a month traversing the South Island searching for them.

He and Andrew say they have put up about 400 signs and spent at least NZ$20,000 in their mission.

"Our dogs to us are like our family, we just know they are out there somewhere," Funnell said. "New Zealand is really not that big a place."

The saga started when Andrew went to feed the couple's chickens and let the dogs out of the car. They ran off, perhaps chasing a rabbit, and did not return.

"We called and called, and they didn't come," said Funnell. "We love our animals. They are great wee dogs. We are not going to give up until we find them."

Members of the public have helped with putting up signs which are now spread throughout country – from the tip of the North Island to the bottom of the South Island.

The couple have raised more than $10,000 to help with the search from almost 300 donors. "We got a huge amount of support throughout New Zealand and we are lucky to have that," Funnell said.

Funnell thinks the dogs were picked up by tourists after a sighting came through of two dogs being tied to a campervan in the area.

"We have been through a rollercoaster of emotions in the process of it all. We are sure they are alive. We have come to being positive about things," said Funnell.

"We can feel them out there."

Source: The Guardian (July 20, 2020), https://www.theguardian.com/world/2020/jul/20/new-zealand-is-not-that-big-a-place-the-nine-month-20000-search-for-two-lost-dogs

Article 3:

American Airlines To Phase Out Complimentary Cabin Pressurization

FT. WORTH, TX—Explaining that the costs of the service have grown too high in recent years, American Airlines announced Tuesday that it will no longer offer free cabin pressurization to passengers starting March 15. "Unfortunately, to stay competitive as a legacy carrier in today's air travel market, it no longer makes economic sense for us to provide breathable air at altitude," said American Airlines CEO Doug Parker, noting that despite the cutbacks, air pressurization would still be available to first- and business-class travelers as well as those willing to pay an additional fee. "While we regret any altitude sickness, blood problems, dimmed vision, or hyperventilation that may result from air pressure less than a third normal levels, we remind our customers that such effects will diminish as soon as the aircraft descends below 10,000 feet." Parker added that the company is also planning to discontinue complimentary landing gear on flights under four hours.

The Onion (25 February, 2014)

https://www.theonion.com/american-airlines-to-phase-out-complimentary-cabin-pres-1819576190

Article 4:

Nutritionists Admit You Can Just Eat Hotdogs And Live Like That For Basically Decades

DENVER—Conceding that people can, in fact, survive indefinitely on a daily diet consisting solely of hotdogs, top nutritionists admitted Wednesday that you could just eat hotdogs and live for basically decades. "We put a lot of work into formulating dietary guidelines based on discoveries and advancements in the field of food science, but honestly, if you just ate hotdogs three times a day every day, you'd be okay," said nutritionist Alison Lawler, noting begrudgingly that a supermarket hotdog contains sufficient proteins, carbohydrates, and minerals to sustain an average human well into their 80s. "You won't be healthy per se, but you'd last on hot dogs for years and years. You wouldn't feel great, you'd be a bit weak and tired, but that's about it. And you'd most likely be reasonably happy, because hot dogs are tasty and satisfying. Now, by no means are we recommending that you stock your pantry full of hot dogs, but we have to admit, that wouldn't be the end of the world." At press time, the nutritionists were not available for further comment as they had all gone out for hotdogs.

The Onion (20 July, 2020).

https://www.theonion.com/nutritionists-admit-you-can-just-eat-hot-dogs-and-live-1844383727

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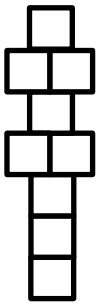
12. Sports

Sadiq Public School's curriculum is more than just academic subjects. This is one of the main ways that Sadiq Public School is so unique. We aim for all students to learn the value of team sports sportsmanship and good health through regular physical activity. You can learn some of these even while at home.

1. Choose 2-3 physical exercises and practice doing these every day. It may be press ups, step ups (walking up and down 3-4 stairs repeatedly), star-jumps, squats… You should do 2-3 of these every day for about 30 minutes every day. Early in the morning is probably better. You are aiming to make it a daily habit that you will still be doing when you're 50 years old. You can challenge yourself to do more each day or more in the 30 minute session. You can challenge your parents (but remember that they're very old and so be gentle with them).
2. Think of a skill-based physical activity that involves some coordination, such as jugging three balls or skipping rope. Now teach yourself how to do this. And when you're proficient, teach someone else. Why? Doing these things occupies your brain and that means you're not thinking about other things – so these activities become a good way to relax, distract your brain from things that are causing you stress (like exams!)
3. Ball games are good for reducing stress, and sneakily using up energy and so keeping you for and healthy and helping you to sleep properly. If you have brothers and sisters at home you can ball games like mini-cricket, catching & throwing, bouncing a ball against a wall and catching it (who knows you may be selected as wicket-keeper for the 1st XI).
4. Hop-scotch. You might have to ask your parents how to play this. With chalk, draw a grid of 9 squares on a paved area…



Stand at the bottom of the grid. Each square has a number 1-9 in it (I can't draw the number with my computer, but you can with chalk.) Use a small stone and slide it first to the 1st square. Hopping, jump over the square with the stone in it, continue hopping up the grid in the correct order, torn around, hop back to the 2 square, bend down and pick up the stone (you're not to put your other foot on the ground otherwise it's too easy), and then back to the start. If you succeed, now slide the stone to the 2 square and hop away, and back, bend down pick up the stone, hop to the start… etc. If you miss the square with you stone, or you put your non-hopping foot down your turn has ended and the next player starts. Yes, parents can play too, but not your neighbours or your cousins who live in Lahore because they're staying home and staying safe. If you don't like my rules, make your own. But once you make the rules, no cheating.

13. Community service

Community service simply means serving our community – doing something to help the community. In the current situation we can all serve our community by staying at home / staying away from other people and washing our hands frequently with soap because when we do this we stop the virus being passed from one person to another. If we all do this, our whole community will be helped.

You can help the whole world's community by doing what you can to reduce plastic waste. You can do this by refusing plastic bags at shops. Make your own paper bags at home and take these to the shops and so not use plastic bags. Buy less (or even none) products that have plastic packaging. Glass can be recycled and so that's fine.

Bury biodegradable waste in your garden rather than send it by rubbish truck to a dump somewhere. Fruit, vegetable scraps, leftover food etc. will rot in your garden and so quickly convert back into soil and return nutrients to plants. Paper waste will do the same.

Turn off lights and other electricity-users when not needed and do not let water taps run needlessly.

Look for ways to help others. Practise saying, 'can I help you?' with family members and then helping will become part of who you are.

There is an interesting theory that the virus that has caused this current situation was passed to humans because animal habitats, especially forests, are being destroyed. Destroying forests, whether for the timber, for clearing land to use for agriculture, or simply to burn the wood as fuel, is called deforestation and it is the main cause of climate change. The next few pages will help you learn more about deforestation and its very bad effects on the planet and human life.

Lesson 2. Deforestation

Deforestation is the removal of forest from land which is then converted to agricultural or urban use. Most deforestation occurs in tropical rainforests such as the Amazon Rainforest.

Between 2000 and 2012, about 890,000 square miles of forests around the world were cut down. Only about 2.4 million square miles of the Earth's original 6 million square miles of forest remains. An area about size of a football field is cleared from the Amazon rainforest every minute for agriculture.

Deforestation is a significant contributor to global warming because it is responsible for about 20% of all greenhouse gas emissions.

According to the UN's Food and Agriculture Organization, almost 80% of all deforestation is driven by agriculture. The UN Framework Convention on Climate Change says the primary cause of deforestation is agriculture.

Subsistence farming is responsible for almost half of all deforestation (48%), with commercial agriculture (32%; logging (14%), and fuel wood (5%) the other causes.

The EU is a major importer of agricultural products, such as palm oil, soy, and cocoa, products commonly associated with agricultural land that was recently forested land. EU countries are keen to reduce the impact of their commercial activities on forests and deforestation. France's government, for example, announced it will 'encourage every actor (producers, businesses, investors, and consumers), to change their practices in order to reduce deforestation.' The French government passed a law stating that palm oil is not considered a biofuel.

In 2008, the EU agreed to stop global forest cover loss by 2030. The UN declared a Sustainable Development Goal of ending deforestation by 2030.

Which countries are worst affected by deforestation?

South & Central America
Large areas of Brazil's share of the Amazon rainforest is being destroyed by illegal logging, exacerbated by government corruption. Deforestation in Peru's share of the Amazon rainforest is due to illegal logging and clearing forests for use as agricultural land. Bolivia's large soya industry and cattle-ranching are the country's main causes of deforestation and the Bolivian government is unlikely to risk the country's food security. Mexico's avocado industry is responsible for the loss of tropical and pine forests.

Asia Pacific
Indonesia's palm oil industry has driven destruction of its rainforest and also its wetlands, with more than 5000 square miles cut down annually to supply palm oil. More than 2000 square miles of Russia's vast forests are lost to wildfires annually. Logging and the palm oil industry account for about 1000 square miles of trees lost in Papua New Guinea annually.

Africa
In Sudan, about 500 square miles of trees are cut down every year to be used as household cooking fuel and heating, and for commercial production of steam-generated electricity. Just 6% of Nigeria's original forests remain because of trees being cut for household cooking fuel and heating.

While these countries are where deforestation is occurring the most, all countries are affected by deforestation because it is a significant factor in global warming and therefore climate change.

Activities

1. Write the following words into your book and then write an explanation of the word.

deforestation
agricultural
rainforest
greenhouse gas
primary cause
subsistence farming
logging
fuel wood
palm oil
sustainable
corruption
food security

2. Explain why deforestation is a problem for our environment.

3. Explain which countries/regions are most affected by deforestation.

4. Describe the main causes of deforestation.

5. Research: Explain how cutting a tree down contributes to green house gas emissions and therefore global warming.

6. Create: Write a letter to Bolivia's President asking for Bolivia's government to please stop deforestation.

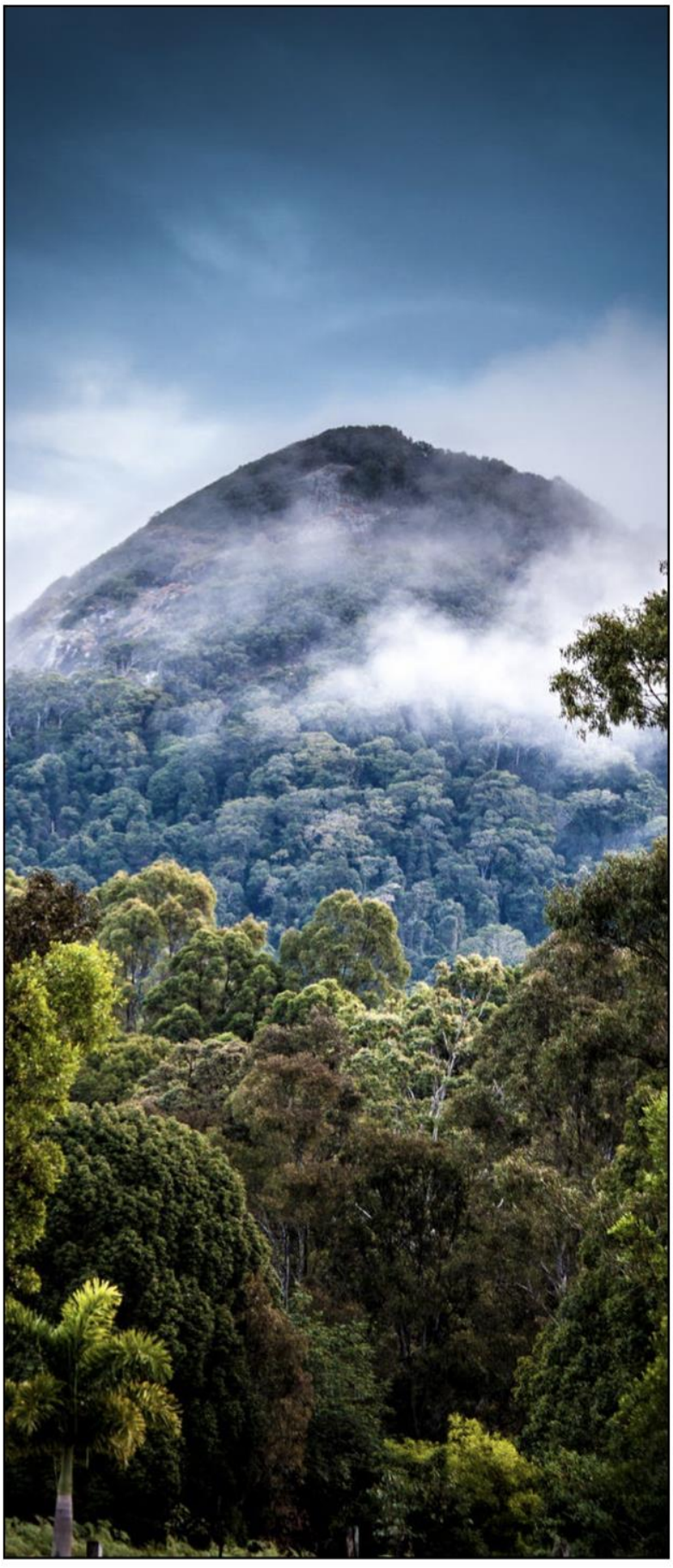
7. Critical thinking: Describe how might you check this article to be sure it is accurate.

8. Reflect: List at least three things you learnt about deforestation from this material.

9. List 3 questions related to information in this article to which you would like answers. Describe how could you find the answers to your questions and how you can be sure they are accurate.

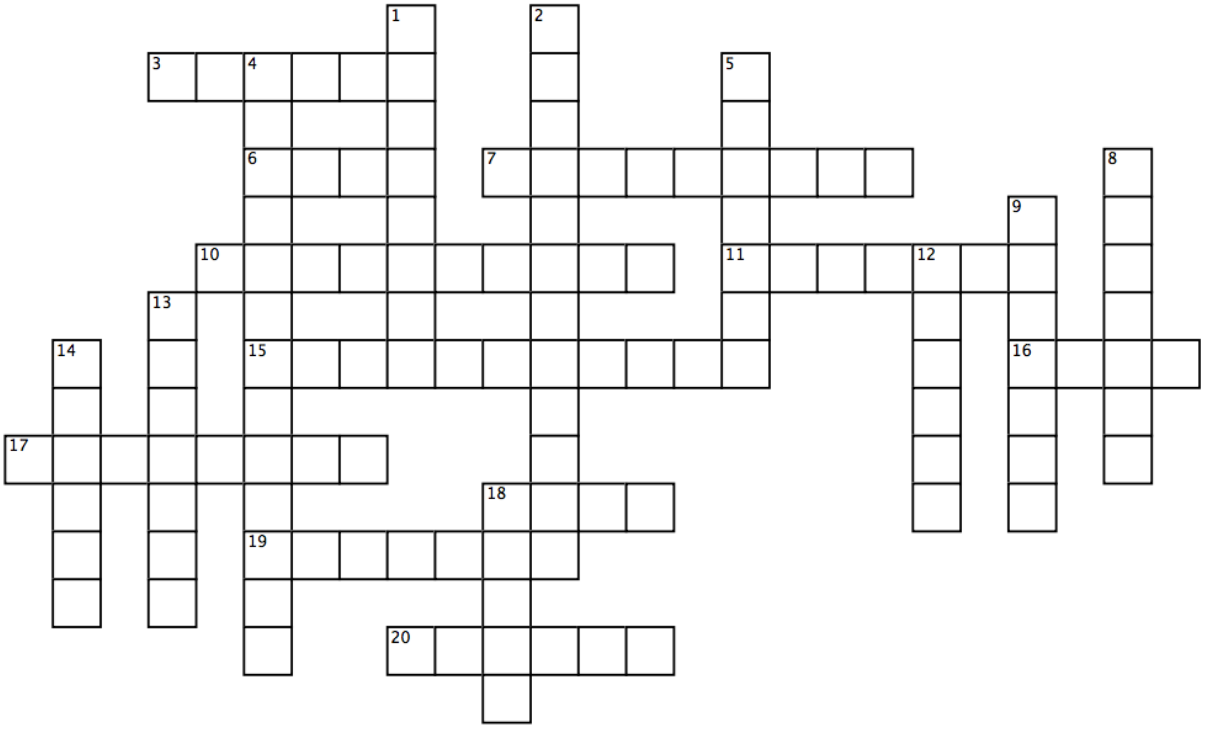
What can I do?

1. Learn more about the forests near where you live. Learn what plants and animals live in the forest. When you know about a forest, you will be more inclined to take care of it.
2. Ask your friends to visit a forest so they can learn about it. Is there anything you and your friends can do? Gathering plastic trash from the forest, for example.
3. Palm oil, soy, beef, and cocoa are the main agricultural products that are responsible for global deforestation. Use the internet to find out what products these ingredients are used to make, for example palm oil is used in the production of some low-quality chocolate and soap. Find out which companies use it and stop buying their products.
4. Write to the companies that use these products and tell them you have stopped buying their products because they are major causes of deforestation.
5. Use your social media accounts to tell your friends about deforestation, what its effects are, what causes it, and what they can do to help.
6. Send emails to government officials and tell them you do not want your country contributing to deforestation by buying these products.
7. Find a local organization that plants trees and help.
8. Grow seedlings and when they are big enough, plant them around your neighborhood. Encourage your teachers to start a program in your school in which students grow seedlings and plant them in an area that needs trees.



Deforestation 1

Answer the crossword using information from the article.



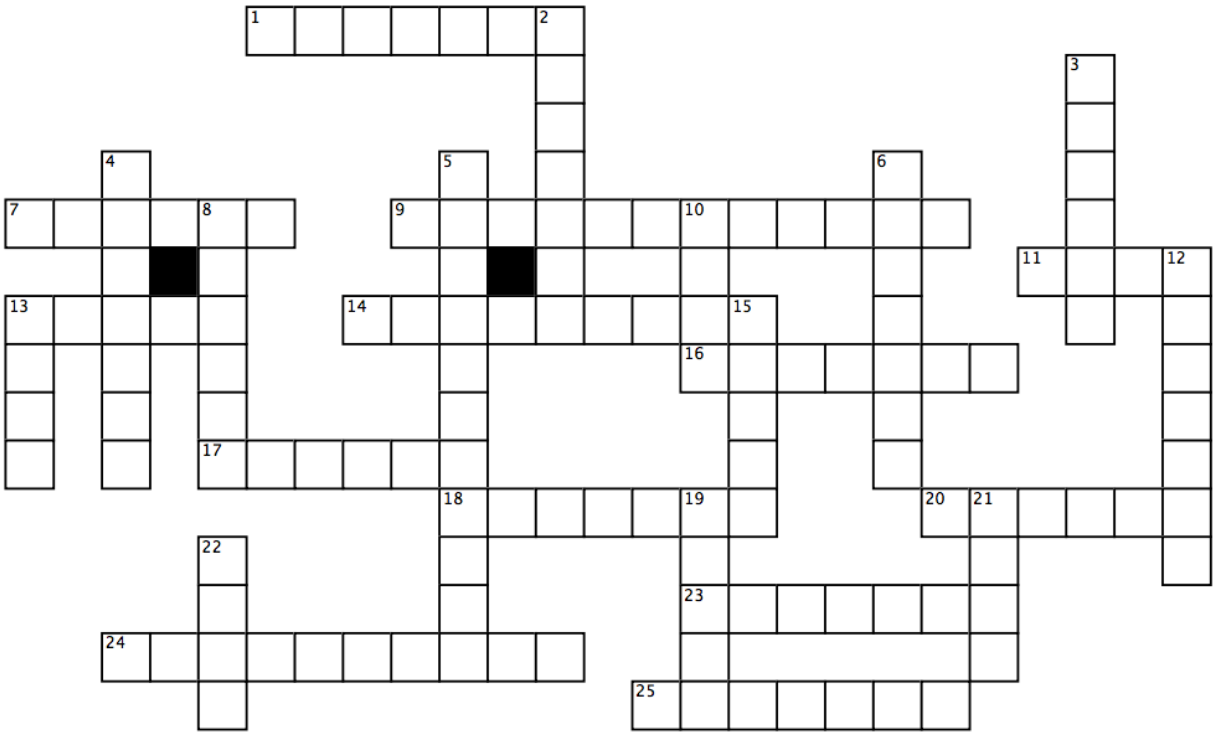
Across

3. France's government announced it will 'encourage every actor (producers, businesses, investors, and consumers), to change their practices in order to _____ deforestation.'
6. In Sudan, trees are cut down to be used as household cooking _____ and heating, and for commercial production of steam-generated electricity.
7. More than 2000 square miles of Russia's vast forests are lost to _____ annually.
10. Deforestation is responsible for about 20% of all _____ gas emissions.
11. Mexico's _____ industry is responsible for the loss of tropical and pine forests.
15. _____ farming is responsible for almost half of all deforestation.
16. The UN declared a Sustainable Development _____ of ending deforestation by 2030.
17. An area about size of a _____ field is cleared from the Amazon rainforest every minute for agriculture.
18. The French government passed a law stating that _____ oil is not considered a biofuel.
19. Deforestation in Peru's share of the Amazon rainforest is due to _____ logging and clearing forests for use as agricultural land.
20. Only about 2.4 million _____ miles of the Earth's original 6 million _____ miles of forest remains.

Down

1. Indonesia's palm oil industry has driven destruction of its rainforest and also its _____.
2. The EU is a major importer of _____ products, such as palm oil, soy, and cocoa.
4. _____ is the removal of forest from land which is then converted to agricultural or urban use.
5. All countries are affected by deforestation because it is a significant factor in global warming and therefore _____ change.
8. The _____ cause of deforestation is agriculture.
9. Large areas of Brazil's share of the Amazon rainforest is being destroyed by illegal _____, exacerbated by government corruption.
12. Most deforestation occurs in tropical rainforests such as the _____ Rainforest.
13. Just 6% of Nigeria's original forests remain because of trees being cut for household cooking fuel and _____.
14. Deforestation is a significant contributor to _____ warming.
18. Logging and the palm oil industry account for about 1000 square miles of trees lost in _____ New Guinea annually.

Deforestation 2



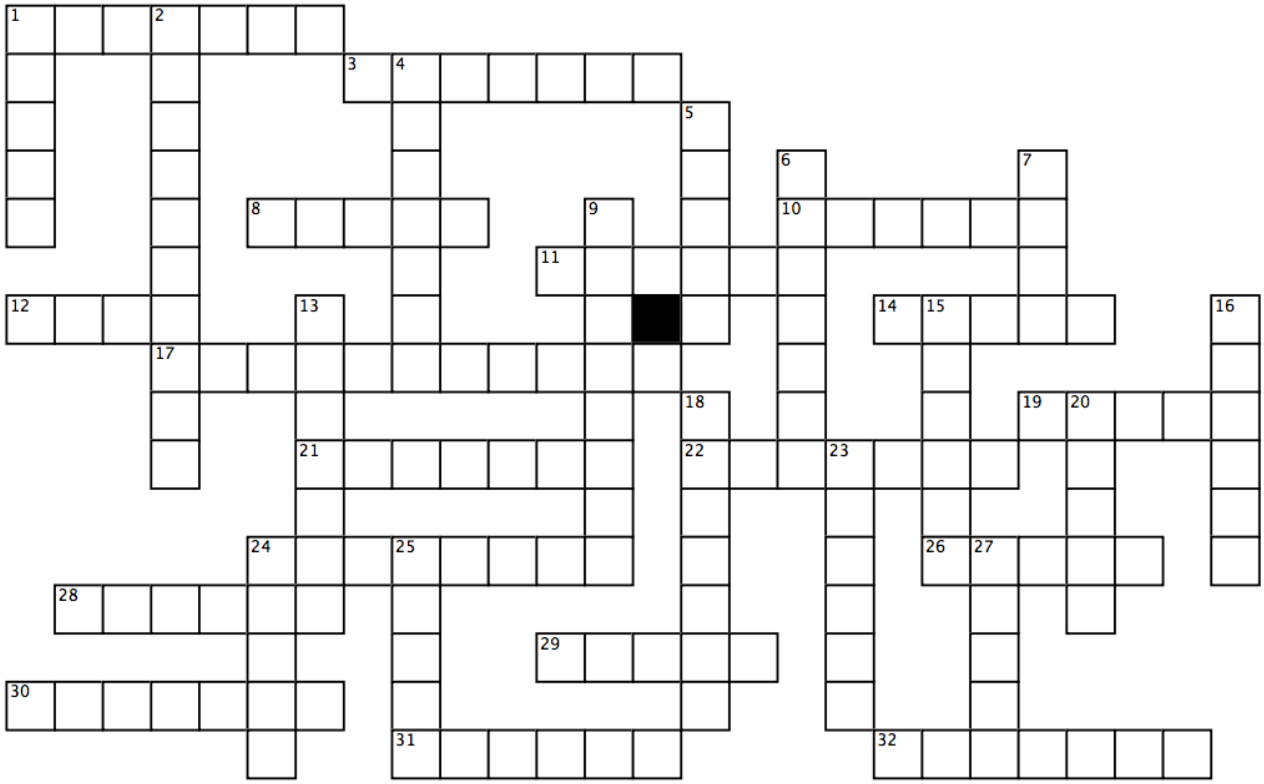
Across

1. 80% of all land _____ and plants live in forests.
7. Forests absorb greenhouse gases that would otherwise fuel _____ warming.
9. Deforestation occurs because people clear forested land to make space for _____ activities such as cattle ranching.
11. Forests keep the _____ moist by blocking the sun and inhibiting evaporation.
13. Cutting down _____ releases carbon dioxide into the atmosphere.
14. Deforestation of tropical rainforests adds more carbon dioxide to the atmosphere than all cars' and trucks' _____.
16. Forests absorb carbon _____ and release oxygen.
17. _____ has the largest area of land deforested.
18. Most deforestation occurs in rainforests which are concentrated in the _____.
20. Deforestation results in more than 1.5 billion tons of _____ dioxide being released into the atmosphere every year.
23. Forests absorb and store carbon, so that when trees are cut down, the carbon is released into the atmosphere contributing to the greenhouse effect whihc causes global warming which causes _____ change.
24. If the current rate of deforestation continues, 100 years from now there will be no more _____.
25. Deforestation occurs because people take wood for household fuel and _____.

Down

2. Forests are home to millions of plant and animal _____.
3. The _____ rainforest is one of the Earth's most threatened forests.
4. _____ are one the main natural factors that regulate and determine the Earth's climate.
5. _____ is one of the most significant causes of deforestation.
6. Deforestation is the main cause of global _____ and therefore climate change.
8. Deforestation has a double effect: it releases carbon dioxide and there are less trees to _____ carbon dioxide.
10. Forests cover a large proportion of the world's _____ area, but large areas of forest are being lost each year.
12. Deforestation is caused by household fuel burning, agriculture, and unsustainable _____.
13. Deforestation is the loss of _____ cover, due to forests being cleared.
15. Forests are called 'carbon _____' because they trap or hold carbon.
19. Forests play a significant role in the water _____ by releasing water vapor into the atmosphere.
21. Although Brazil has lost the largest _____ of forest, Comoros has lost 50% of its forests.
22. Forests prevent _____ erosion.

Brazil



Across

1. Early sailors often called Brazil Terra di Papaga (Land of _____).
3. Rio de Janeiro is home to two well known _____, the Ipanema and the Copacabana.
8. The predominant religion throughout Brazil is _____ Catholic.
10. Brazil has been the world's largest producer of _____ for more than 150 years.
11. The Alchemist, by the Brazilian author Paulo _____ de Souza, has sold over 83 million copies, and so is one of the most sold books ever.
12. Brazil spans _____ time zones.
14. Sao _____ is the most populous city in the southern hemisphere.
17. Brazil's Itaipu Dam generates the most _____- of all the world's hydroelectric plants.
19. In the 16th century Brazil's major export was _____, but in the 17th century it was gold.
21. Brazil is the largest country in South _____.
22. Rio de Janeiro hosted the 2016 _____ Games and 2016 Paralympic Games.
24. In September 1822 Brazil declared independence from _____ and declared Prince Pedro de Alcântara the first Emperor of the Brazilian Empire.
26. Most Brazilians _____ Portuguese.
28. The Iguazu Falls are on the Brazil-Argentina _____.
29. The Amazon River _____ includes the vast Amazon rainforest.
30. Brasilia was planned and developed in 1956 to move the capital from Rio de _____ to a more central location.
31. Deforestation of the _____ rainforest has a double-effect on the greenhouse effect and therefore climate change: living trees store CO2 and dead trees release CO2 into the atmosphere.
32. In 2014-2016 a severe _____, caused by El Nino, had a significant impact on Sao Paulo and Rio de Janeiro.

Down

1. In 1831, Brazil's Emperor, Pedro I abdicated, returned to Portugal, and passed the monarchy to his five year old son, _____ II who was eventually crowned in 1841.
2. The Amazon _____ has the greatest biological diversity in the world.
4. Brazil is the only country with the _____ and the Tropic of Capricorn running through it.
5. The final of the 2014 football _____ Cup was played at the Maracana Stadium in Rio de Janeiro
6. Brazil's _____ is eighth-largest by GDP.
7. Brazil's currency, the _____, is pegged to the US dollar.
9. Brazil's national sport is _____ and the men's national team has won the World Cup 5 times.
13. Brazil borders all South American countries except _____ and Chile.
15. Brazil remained neutral in World War 2 until 1942, at which time it joined the _____.
16. The _____ the Redeemer statue overlooking Rio de Janeiro is 30 metres tall and was built in 1931.
18. The Amazon basin includes land in Brazil as well as _____, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela.
20. 85% of Brazil's population live in _____ areas.
23. The Christ the Redeemer statue overlooking Rio de Janeiro is 30 _____ tall and was built in 1931.
24. In 1500 _____ Alvares Cabral claimed the area of Brazil for the Portuguese Empire and it remained a Portuguese colony until 1808.
25. Brazil's original official name was _____ da Santa Cruz (Land of the Holy Cross).
27. Brazil's capital city is Brasilia, but the largest city is Sao _____.