

1

White paint costs £2.80 per litre.

Blue paint costs £3.50 per litre.

White paint and blue paint are mixed in the ratio 3 : 2

Work out the cost of 18 litres of the mixture.

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Answer £ \_\_\_\_\_

**(Total 4 marks)**



(b) The percentage of blue beads is 90%

Work out the value of  $x$ .

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Answer \_\_\_\_\_

(3)

(Total 5 marks)

4

Work out the value of  $x$  when

$$x - 20 : x + 280 \text{ simplifies to } 1 : 4$$

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Answer \_\_\_\_\_

(Total 4 marks)

5

2476 adults watch a cricket match.

The ratio men : women is 3 : 1

How many **more** men than women watch the match?

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Answer \_\_\_\_\_

(Total 3 marks)





8

The volume of a medal is  $45 \text{ cm}^3$

The medal is made from copper and tin.

$$\text{volume of copper : volume of tin} = 22 : 3$$

The density of copper is  $8.96 \text{ g / cm}^3$

The density of tin is  $7.31 \text{ g / cm}^3$

Work out the mass of the medal.

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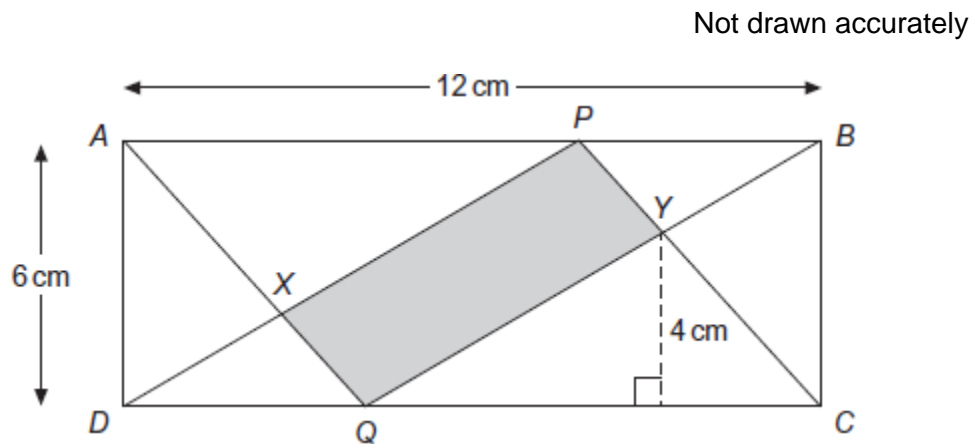
Answer \_\_\_\_\_ grams

(Total 4 marks)

9

$ABCD$  is a rectangle.

$P$  and  $Q$  are such that  $AP : PB = CQ : QD = 2 : 1$





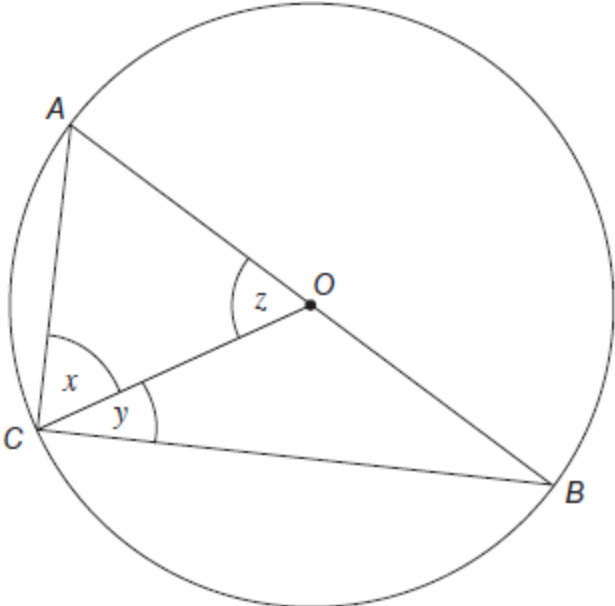




12

(a)  $A, B$  and  $C$  are points on a circle, centre  $O$ .

Not drawn accurately



$AB$  is a diameter.

The ratio of the size of angle  $x$  to the size of angle  $y$  is

$$x : y = 5 : 1$$

Work out the size of angle  $z$ .

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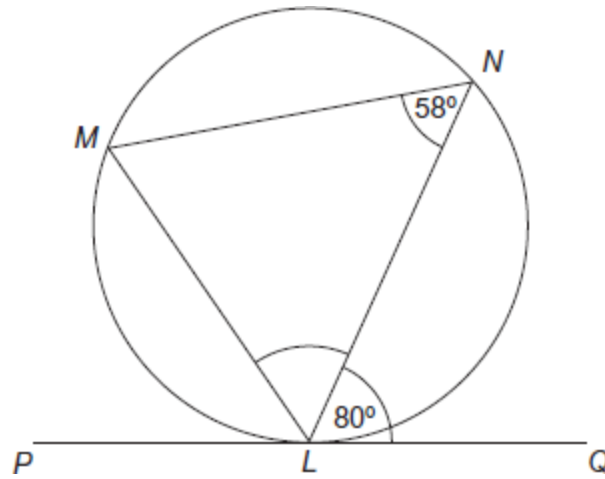
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Answer \_\_\_\_\_ degrees

(3)

- (b)  $L$ ,  $M$  and  $N$  are points on a circle.  
 $PLQ$  is a tangent.

Not drawn accurately



Work out angle  $MLN$ .

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Answer \_\_\_\_\_ degrees

(3)  
(Total 6 marks)

13

During a game, players can win and lose counters.

At the start of the game

Rob, Tim and Zak share the counters in the ratio 5 : 6 : 7

At the end of the game

Rob, Tim and Zak share the **same number** of counters in the ratio 7 : 9 : 8

Show that Rob ends the game with more counters than he started with.

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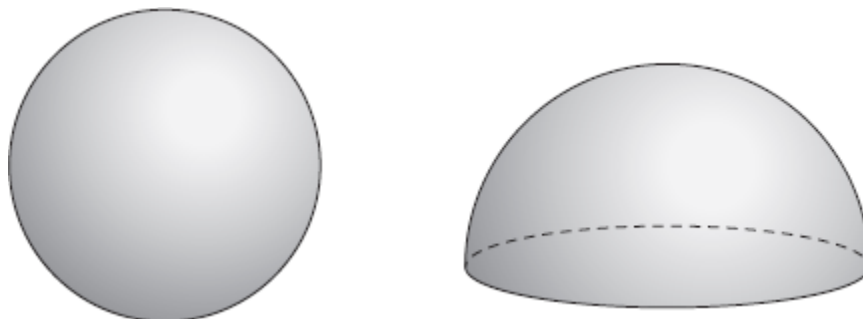
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(Total 3 marks)

14

The diagram shows a sphere, radius 6 cm, and a solid hemisphere, radius 9 cm



Work out the ratio

surface area of the sphere : **total** surface area of the hemisphere

Give your answer in its simplest form.

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Answer \_\_\_\_\_ : \_\_\_\_\_

**(Total 5 marks)**

## Mark schemes

**1**

### Alternative method 1

$18 \div (3 + 2)$  or 3.6

**M1**

their  $3.6 \times 3 \times 2.8(0)$  or 30.24(0)

**M1dep**

their  $3.6 \times 2 \times 3.5(0)$  or 25.2(0)  
*dep on first M1*

**M1dep**

55.44

**A1**

### Alternative method 2

$3 \times 2.8(0) + 2 \times 3.5(0)$  or 15.4(0)

**M1**

$18 \div (3 + 2)$  or 3.6

**M1**

their  $3.6 \times$  their 15.4(0)  
*dep on M1 M1*

**M1dep**

55.44

**A1**

### Alternative method 3

$3 \times 2.8(0) + 2 \times 3.5(0)$  or 15.4(0)

**M1**

their  $15.4(0) \div 5$  or 3.08

**M1dep**

their  $3.08 \times 18$

**M1dep**

55.44

**A1**

**[4]**

**2**

### Alternative method 1

2 parts  $\rightarrow$  116

*oe*

**M1**

$$116 \div 2 \times 16$$

oe

M1

928

A1

### Alternative method 2

Writes at least 3 ratios or numbers of boys and girls equivalent to 9 : 7

eg 18 : 14 and 180 : 140 and 360 : 280

M1

522 and 406

M1

928

A1

[3]

3

(a)  $\frac{x^2}{x + 2x + x^2}$  oe

Condone numerator as  $x$  or  $2x$

M1

$$\frac{x^2}{3x + x^2} = \frac{x}{x + 3}$$

SC1 chooses a value for  $x$ , evaluates the correct numbers of each colour bead and shows that the fraction of blue beads

can be written in the form  $\frac{x}{x+3}$

or  $\frac{x^2}{x(3+x)} = \frac{x}{x+3}$

eg.  $x = 3$ , red = 3, white = 6, blue = 9 and  $\frac{9}{18} = \frac{3}{6}$

A1

(b)  $\frac{x}{x+3} = 0.9$  oe

M1

$$x = 0.9x + 2.7 \text{ or } 0.1x = 2.7$$

M1

$$(x =) 27$$

A1

### Alternative method 1

Chooses a value for  $x$ , evaluates the correct numbers of each colour bead and the correct proportion of blue beads.

eg 3, 6, 9 and

$\frac{1}{2}$  (oe fraction, decimal or percentage)

M1

Chooses a value for  $x$ , evaluates the correct numbers of each colour bead and the correct proportion of blue beads, for a proportion closer to 90%

eg 3, 6, 9 and

$\frac{1}{2}$  (oe fraction, decimal or percentage)

and

4, 8, 16 and

$\frac{4}{7}$  (oe fraction, decimal or percentage)

M1

( $x =$ ) 27

A1

### Alternative method 2

$$\frac{90}{100} = \frac{18}{20} \text{ or } \frac{36}{40} \text{ or } \frac{45}{50} \text{ or } \frac{54}{60}$$

$$\text{or } \frac{63}{70} \text{ or } \frac{72}{80} \text{ or } \frac{81}{90}$$

M1

$$\frac{27}{30}$$

M1

( $x =$ ) 27

A1

[5]

**4****Alternative method 1**

$$\frac{x-20}{x+280} = \frac{1}{4}$$

or  $4(x - 20) = x + 280$

oe

**M1**

$$4x - 80 = x + 280$$

or  $x - 20 = \frac{x}{4} + 70$

oe correct expansion of their brackets or division  
scores M2

**M1**

$$4x - x = 280 + 80$$

or  $3x = 360$

or  $x - \frac{x}{4} = 70 + 20$

or  $\frac{3x}{4} = 90$

collecting their four terms  
scores M3

**M1**

$$x = 120$$

SC3 – 380

**A1**

**Alternative method 2**

$$x + 280 - (x - 20) (= 3 \text{ parts})$$

**M1**

$$300 (= 3 \text{ parts}) \text{ and } 100 (= 1 \text{ part})$$

scores M2

**M1**

$$x - 20 = 100 \text{ or } x + 280 = 400$$

scores M3

**M1**

$$x = 120$$

SC3 – 380

**A1**



**Alternative method 3**

$$x - 20 + x + 280 = 5(x - 20)$$

M1

$$2x + 260 = 5x - 100$$

*scores M2*

M1

$$3x = 360$$

*scores M3*

M1

$$x = 120$$

*SC3 – 380*

A1

**Additional Guidance**

$$x - 20 = 4(x + 280)$$

M0

$$x - 20 = 4x + 1120$$

M1

$$-1140 = 3x$$

M1

[4]

5

$$2476 \div (3 + 1) \text{ or } 619$$

*oe*

M1

their  $619 \times (3 - 1)$  or their  $619 \times 2$

or

$$2476 \div (3 - 1) \text{ or } 2476 \div 2$$

or

$$\text{their } 619 \times 3 - \text{their } 619$$

or

$$(2476 - \text{their } 619) - \text{their } 619$$

or

$$1857 - 619$$

*oe*

M1

$$1238$$

A1

**Alternative method**

$$(3 + 1) \div (3 - 1) \text{ or } 4 \div 2$$

or

$$(3 - 1) \div (3 + 1) \text{ or } 2 \div 4$$

oe

M1

$$2476 \div \text{their } 2$$

$$\text{or } 2476 \times \text{their } \frac{1}{2}$$

oe

M1

$$1238$$

A1

[3]

6

$$2(3x - 9) = 5x - 11$$

*oe Must be correct and have x on both sides*

M1

$$6x - 18 = 5x - 11$$

*oe their bracket(s) expanded correctly*

M1

$$x = 7$$

A1

$$2 \times \text{their } 7 + 4 \text{ or } 18$$

and

$$5 \times \text{their } 7 - 11 \text{ or } 24$$

*Substitutes their value of x in*

$$2x + 4 \text{ and } 5x - 11$$

M1

$$18 : 24 \text{ and } 3 : 4$$

$$\text{oe eg } \frac{18}{24} \text{ and } \frac{3}{4}$$

A1

**Additional Guidance**

$$3x - 9 = 2(5x - 11)$$

M0

$$3x - 9 = 10x - 22$$

M1

$$x = \frac{13}{7}$$

A0

$$2 \times \frac{13}{7} + 4 \text{ and } 5 \times \frac{13}{7} - 11$$

M1 A0

T & I leading to  $x = 7$

M1 M1 A1

[5]

**7**

**Alternative method 1**

$$3x - 6 \text{ and } 4x$$

M1

$$\frac{3x - 6}{4x} = \frac{5}{8} \text{ or } x = 12$$

oe

M1

48

A1

**Alternative method 2**

$a : b$  or  $\frac{a}{b}$  equivalent to  $3 : 4$  with

$a$  and  $b > 10$  and  $a - 6 : b$

or  $\frac{a - 6}{b}$  seen

M1

$$30 : 48 \text{ or } \frac{30}{48}$$

A1

48

A1

[3]

8

**Alternative method 1**

$45 \div (22 + 3)$  or  $45 \div 25$  or 1.8

oe eg  $\frac{45}{25}$

**M1**

$22 \times$  their 1.8 or 39.6

or

$3 \times$  their 1.8 or 5.4

**M1dep**

their  $39.6 \times 8.96$  + their  $5.4 \times 7.31$

or [354, 355] + [39, 40]

**M1dep**

394.29 or 394.3

**A1**

**Alternative method 2**

$45 \div (22 + 3)$  or  $45 \div 25$  or 1.8

oe eg  $\frac{45}{25}$

**M1**

their  $1.8 \times 8.96$  or [16.1, 16.13]

or

their  $1.8 \times 7.31$  or [13.1, 13.2]

**M1dep**

their [16.1, 16.13]  $\times 22$

+ their [13.1, 13.2]  $\times 3$

or [354, 355] + [39, 40]

**M1dep**

394.29 or 394.3

**A1**

### Alternative method 3

$45 \div (22 + 3)$  or  $45 \div 25$  or 1.8

oe eg  $\frac{45}{25}$

**M1**

$22 \times 8.96$  or [197, 197.12]

or]

$3 \times 7.31$  or [21.9, 22]

**M1**

their [197, 197.12]  $\times$  their 1.8

+ their [21.9, 22]  $\times$  their 1.8

or [354, 355] + [39, 40]

oe

dep on M1M1

**M1dep**

394.29 or 394.3

**A1**

### Additional Guidance

Allow up to M2 even if not subsequently used

Ignore units throughout

**[4]**

9

Area of any 2 of the following triangles or parallelograms found (ignore lack of units)

$$DPC = AQB = 36 \text{ cm}^2$$

$$AXP = QYC = 16 \text{ cm}^2$$

$$APD = QCB = 24 \text{ cm}^2$$

$$DQX = BPY = 4 \text{ cm}^2$$

$$AXD = BYC = 8 \text{ cm}^2$$

$$PBC = ADQ = 12 \text{ cm}^2$$

$$DQBP = 24 \text{ cm}^2$$

$$AQCP = 48 \text{ cm}^2$$

*Award M2 only if areas clearly identified either by labelling or writing on diagram*

**NB** Only one from each line can count

*M1 for any one area clearly identified either by labelling or writing on diagram*

*They may also 'double up' triangles and give a total of the two congruent triangles*

*eg  $AXP + QYC = 32 \text{ cm}^2$  this is M1 for 1 pair and M2 for two pairs (do not accept  $DPC + AQB = 72 \text{ cm}^2$  as this is the total area)*

M2

Any suitable correct addition or subtraction of triangles or parallelograms

M1

$$\text{Shaded} = 72 - 56$$

*Their total must be 56*

A1

**Alternative 1**

$$QY = \frac{2}{3} \sqrt{(6^2 + 8^2)} = 6 \frac{2}{3}$$

*QY must be labelled or shown on diagram as 6.67 for example*

M1

$$\text{Angle } PDQ = \tan^{-1}(6 \div 8) (=36.86\dots)$$

M1

(‘height’ of parallelogram)

$$= 4 \times \sin PDQ (= 2.4)$$

M1

$$2.4 \times 6 \frac{2}{3}$$

A1

**Alternative 2**

$AQ = \sqrt{(6^2 + 4^2)} (= 2\sqrt{13} \text{ or } 7.211)$

**and**  $XQ = AQ \div 3 (2.4037..)$

M1

$QY = \frac{2}{3} \sqrt{(6^2 + 8^2)} = 6 \frac{2}{3}$

M1

[4]

**10**

$250 \div 5 \text{ or } 50$

or  $250 \times 3 \text{ or } 750$

or  $250 \times 2 \div 5 \text{ or } 100$

or  $0.12 \times 250 \text{ or } 30$

oe

M1

$\frac{250 \times 3}{5} \text{ or } 150$

or  $250 - \text{their } 100 \text{ or } 150$

or their  $30 \div 5 \text{ or } 6$

or their  $30 \times 3 \text{ or } 90$

oe

M1

$0.12 \times \frac{250 \times 3}{5}$

or  $0.12 \times 150$

or their  $30 \div 5 \times 3$

oe

M1

18

A1

20

*ft 360 ÷ their 18 (rounded up if non integer)*

B1ft

### Additional Guidance

For their final answer, if their 20 is not a whole number then must round answer up correctly to get the final B mark

For those who work out 88% of 150 giving an answer of 132 they will score M1M1 for the 150

150, 18, 132, 3 weeks

M1M1M0A0B1ft

150, 18, 132

M1M1M0A0B0

[5]

11

### Alternative method 1

1 mile per minute

or 60 miles per hour

or 0.15 (hours)

or 1.6 (hours) or  $1\frac{36}{60}$  (hours)

B1

$9 \div 50$  or 0.18

*oe*

M1

$70 \times 1\frac{36}{60}$

or  $70 \times 1.6$  or 112

*oe*

M1

their  $112 \div 40$  or 2.8

*Dep on 2nd M1*

M1dep

2.98

or 2.8 and  $(3 - 0.18 =) 2.82$

or 0.18 and  $(3 - 2.8 =) 0.2$

*Ignore fw*

A1

### Alternative method 2

1 mile per minute

or 60 miles per hour

or 0.15 (hours)

or 1.6 (hours) or  $1\frac{36}{60}$  (hours)

B1



$9 \div 50 \text{ or } 0.18$

oe

**M1**

$70 \times 1\frac{36}{60} \text{ or } 112$   
 $\text{or } 70 \times 1.6 \text{ or } 112$

**M1**

$40 \times (3 - \text{their } 0.18) \text{ or } 112.8$

*Dep on 1st M1*

**M1dep**

$112.8 \text{ and } 112$

*Ignore fw*

**A1**

### **Alternative method 3**

1 mile per minute

or 60 miles per hour

or 0.15 (hours)

or 1.6 (hours) or  $1\frac{36}{60}$  (hours)

**B1**

$9 \div 50 \text{ or } 0.18$

oe

**M1**

$70 \div 40 \text{ or } 1.75$

**M1**

$70 \div 40 \times 1.6 \text{ or } 2.8$

or their  $1.75 \times 1.6$

oe

*e.g.  $1.75 + 0.875 + 0.175$*

*Dep on 2nd M1*

**M1dep**

$2.98$

or 2.8 and  $(3 - 0.18 =) 2.82$

or 0.18 and  $(3 - 2.8 =) 0.2$

*Ignore fw*

**A1**

**Additional Guidance**

Key facts are :

First stage:

- Distance travelled 9 miles (given)
- Time taken 9 minutes (given) or 0.15 hours
- Average speed 60 mph
- Miles per gallon 50 mpg (given),
- Amount of petrol  $9 \div 50 = 0.18$  gallons

Second stage:

- Distance travelled  $70 \times 1.6 = 112$  miles
- Time taken 1 hour 36 minutes (given) or 1.6 hours
- Average speed 70 mph (given)
- Miles per gallon 40 mpg (given),
- Amount of petrol  $112 \div 40 = 2.8$  gallons

An incorrect conversion of 1 hour 36 minutes to 1.36 can score: eg  
 $70 \times 1.36 = 95.2$ ,  $95.2 \div 40 = 2.38$

$70 \times 1.36 = 95.2$ ,  $95.2 \div 40 = 2.38$ ,  $0.18 + 2.38 = 2.56$

$2.98 = 3$  (further work)

$9 \div 50$

**B0M0M1M1A0**

**B1M1M1M1A0**

**B1M1M1M1A1**

**B1M1**

**[5]**

**12**

(a) 90 seen or implied

**B1**

$90 \div 6$  or 15

or  $90 \div 6 \times 5$  or 75  
oe

**M1**

30

**A1**

**Additional Guidance**

30 without working

**B1M1A1**

- (b) Angle  $LMN = 80$   
or angle  $MLP = 58$

*May be on diagram*

M1

$$180 - 80 - 58$$

oe

M1

$$42$$

A1

[6]

13

**Alternative method 1**

$$\frac{5}{6 + 5 + 7} \text{ or } \frac{5}{18}$$

$$\text{or } \frac{7}{9 + 7 + 8} \text{ or } \frac{7}{24}$$

*oe fraction, decimal or percentage*

M1

Attempt to convert to any common denominator

$$\text{eg } \frac{20}{72} \text{ and } \frac{21}{72}$$

or to decimals

eg 0.27(7...) and 0.29

eg 3 0.28 and 0.29)

or to percentages

eg 28% and 29%

*Attempt to convert both to comparable form with one correct*

oe

M1

$$\frac{20}{72} \text{ and } \frac{21}{72} \text{ and Yes}$$

*oe fractions, decimals or percentages*

A1

**Alternative method 2**

Chooses a number of counters that is a multiple of 18 and 24 eg 72

M1

$$5 \times \frac{\text{their } 72}{18} \text{ or } 20$$

$$\text{or } 7 \times \frac{\text{their } 72}{24} \text{ or } 21$$

M1

20 and 21 and Yes

A1

### Alternative method 3

35 : 42 : 49 and 35 : 45 : 40

M1

$$\frac{35}{35 + \text{their } 42 + \text{their } 49} \text{ or } \frac{35}{126}$$

or

$$\frac{35}{35 + \text{their } 45 + \text{their } 40} \text{ or } \frac{35}{120}$$

M1

$$\frac{35}{126} \text{ and } \frac{35}{120} \text{ and Yes}$$

A1

[3]

14

$$4 \times \pi \times 6^2 \text{ or } 144\pi$$
$$\text{or } 452.(\dots)$$

oe

M1

$$2 \times \pi \times 9^2 \text{ or } 162\pi$$
$$\text{or } [508, 509]$$

oe

M1

$$\pi \times 9^2 \text{ or } 81 \pi$$
$$\text{or } 254.(\dots)$$
$$\text{or } 3 \times \pi \times 9^2 \text{ or } 243\pi$$
$$\text{or } 763.(\dots)$$

oe

M1

$$144\pi : 243\pi$$

oe

e.g.

$$452.(...) : 763.(...$$

$$4 \times 6 \times 6 : 3 \times 9 \times 9$$

**M1**

$$16 : 27$$

**A1**

### **Additional Guidance**

$243\pi$  alone implies

**M0 M1 M1 M0 A0**

**[5]**