BUSINESS & ENTERPRISE

The City of Leicester College

Cambridge Technical Sport and Physical Activity – L3

Units of Study

Year 12:

- Unit 1 – Body Systems (90 Credits - Exam)
- Unit 2 – Sports Coaching (90 Credits - Coursework)

Year 13:

- Unit 3 – Sport Organisation and Development (60 Credits – Exam)
- Unit 17 – Sports Injury and Rehabilitation (60 Credits - Coursework)
- Unit 19 – Sport and Exercise Psychology (60 Credits – Coursework)

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Energy Systems

Do Now Activity Recap of Last Topic

Muscle Fibre Types

- Name the three types of muscle fibres?
- Name the characteristics of these fibres?
- Give sporting examples that each of the muscle fibre types would be suited to?

The Big Question

Fact: Food is not energy for movement or performance.

Question: Is eating tailored, performance enhancing diets a pointless process and a false business economy?

Learning Objectives

- To know the different types of energy systems
- To understand which energy systems are used in different sports/activities

Keywords

- Adenosine Tri Phosphate (ATP)
- Creatine Phosphate Energy System(PC)
- Lactic Acid System
- Aerobic Energy System
- Metabolism of Fats

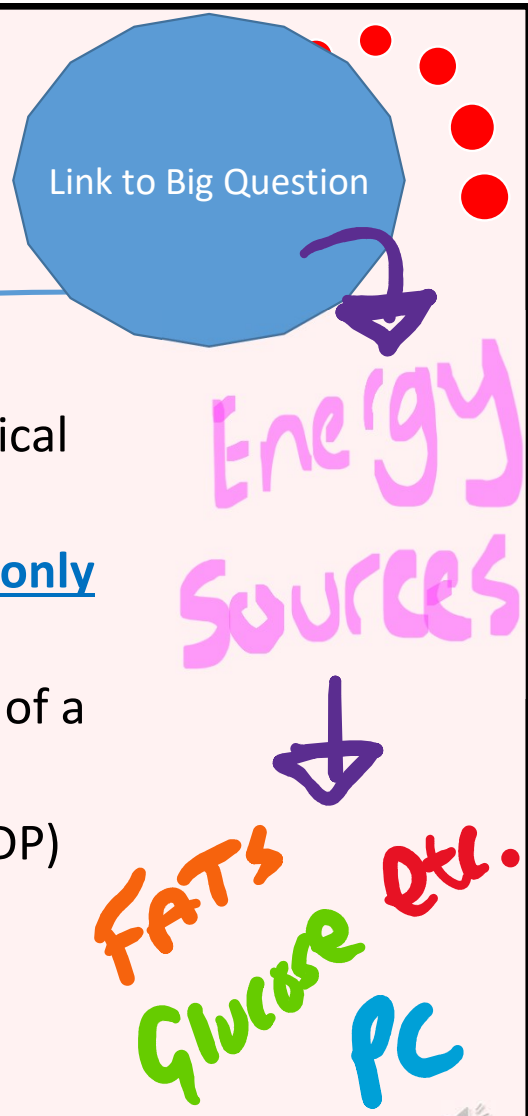
Introduction to Energy

- At all times our bodies are expending energy
- Energy is needed just to exist and to create movement

The **three** different types of energy are:

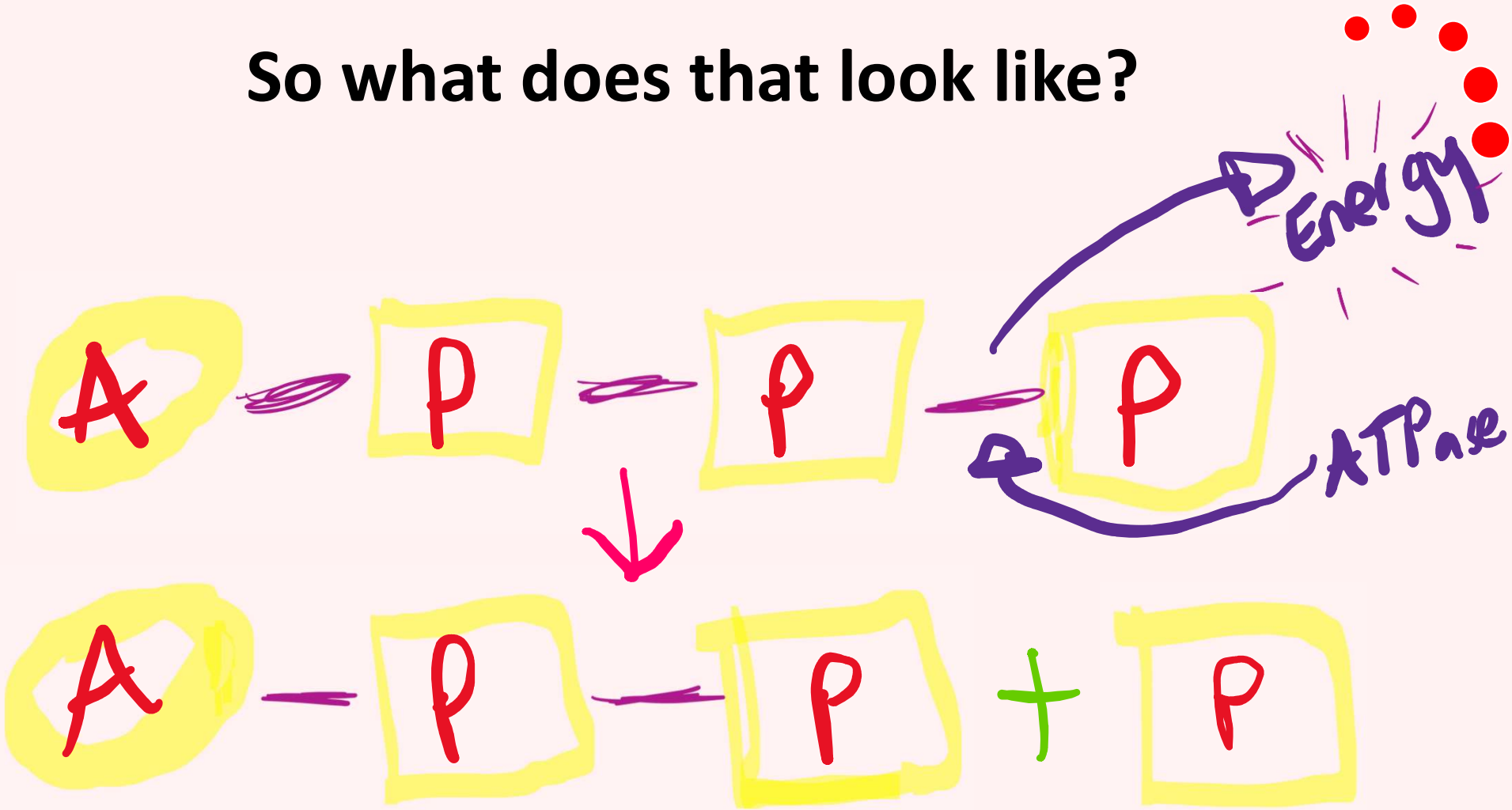
1. **Chemical**
   - Energy produced by a complex of chemical reactions
   - Which can then be made available as:
2. **Kinetic**
   - Energy due to **movement,** which results from muscular contractions
3. **Potential**
   - Is **stored** energy

Introduction to ATP



- The body extracts energy from **food** and then thousands of chemical reactions are responsible for this energy transfer.
- ATP is the ***only*** compound that we can get energy from – **It's the only usable form of energy in the body!**
- Only enough ATP in the body to last ***three seconds*** and it consists of a base **adenine** and **three phosphate molecules.**
- It is formed by a reaction between an Adenosine Diphosphate (ADP) molecule and a phosphate
- Hence, ADP requires energy so as to resynthesise/recreate ATP

So what does that look like?

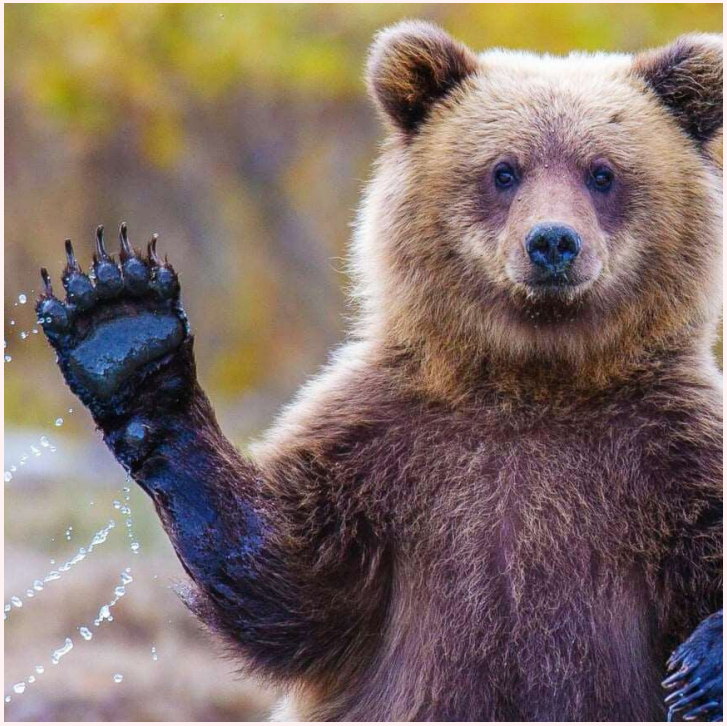


Introduction to ATP

- Energy is stored in the chemical bonds of the molecules
- When a bond is broken energy is released
- When a bond is made energy is stored
- When ADP binds with another phosphate, energy is stored for later use

- **THE ENERGY SYSTEMS** within the body can function **AEROBICALLY AND ANAEROBICALLY – what's the difference?**

So…what does this mean for sport?



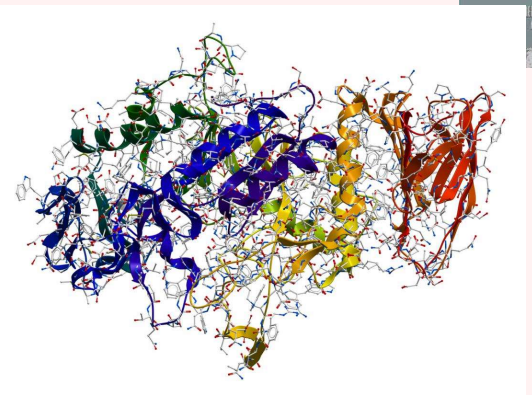
- ATP Splitting provides us with 2-3 seconds of kinaesthetic (movement) performance.
- Raw, stored energy within the muscle itself.
- Quickly accessible
- Used for all initial movement.

- Meaning…we can get a few paces away from the bear…but that's it!!!

Key Point: None of this is possible without enzyme involvement. **Enzymes break things down** and are the basis of our **metabolism**.

How to Remember

- Think 007 – **Casino Royale!!**
- **CYONIDE**
- Stops every single **enzyme = no reactions = no energy** therefore **we die!!!!**



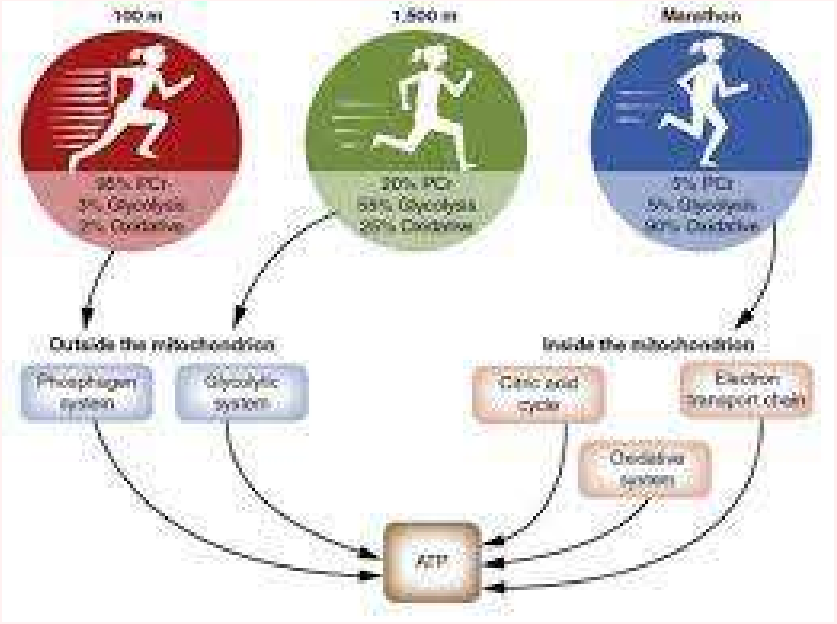
Three Energy Systems

Process:

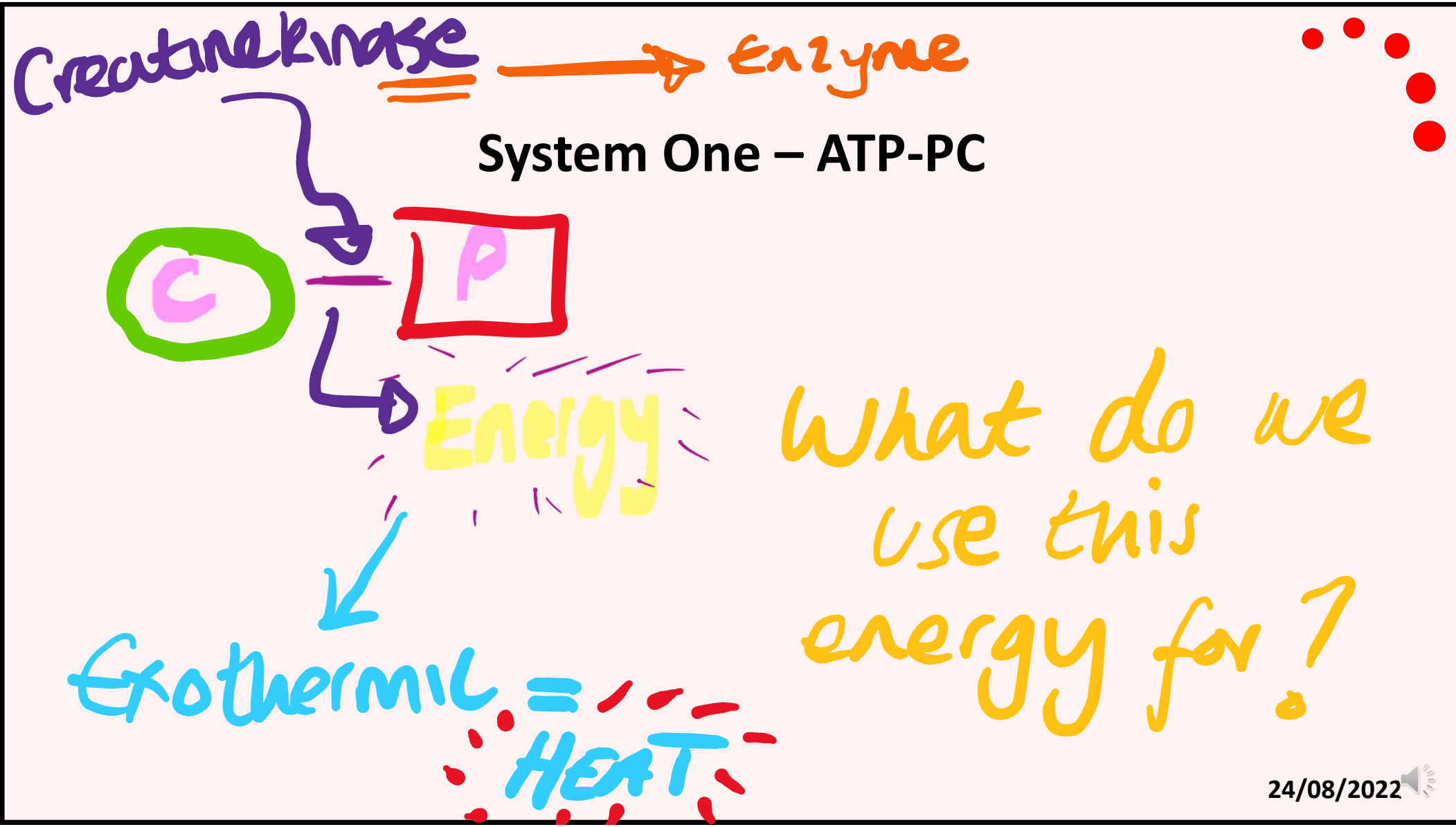
- ATP Splitting (Anaerobic)

Systems:

- ATP-PC (Anaerobic)
- Lactic Acid System (Anaerobic)
- The Aerobic System (Aerobic)
- Fat Metabolism (Aerobic)



System One – ATP-PC



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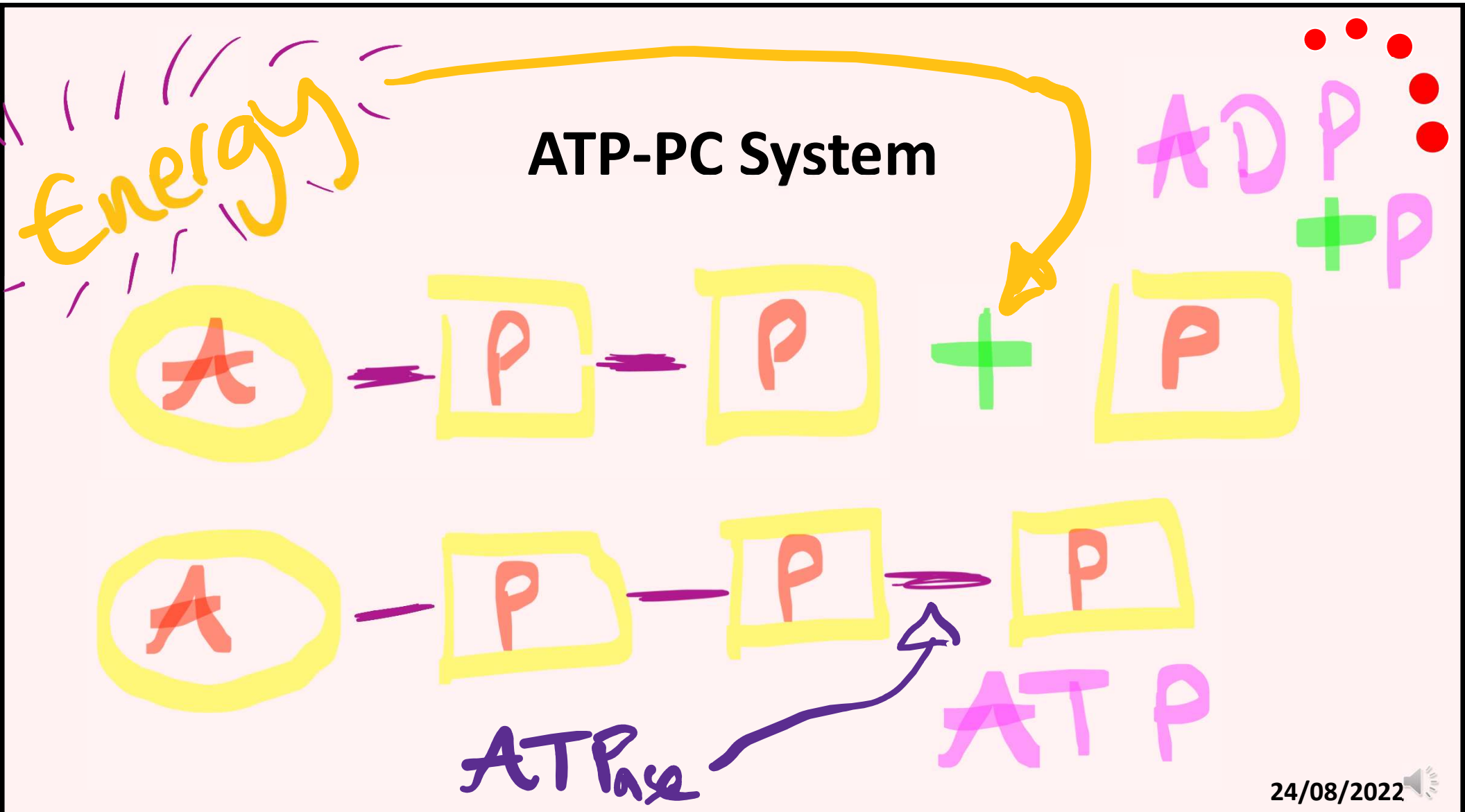
ATP-PC System



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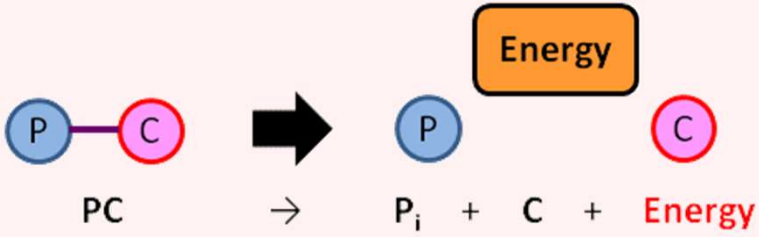
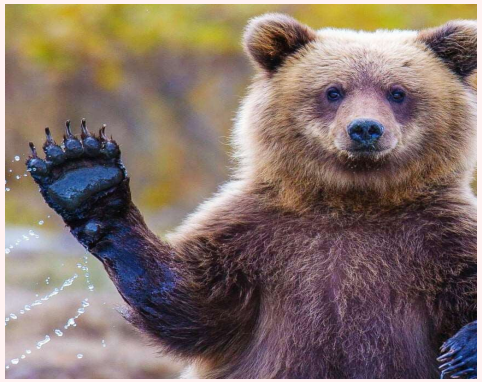
1st Energy System – Resynthesis of ATP via Phosphocreatine as a source.

Key points – recap:



- ATP-PC is an immediate source of energy
- **PC –** Phosphocreatine – this is a high energy compound
- Provides the necessary energy to combine ADP to P
- **Remember ATP lasts 1-3 seconds**
- High intensity – without oxygen
- Lasts **8-9 seconds**



- **Total Performance time = 10-12 seconds…but what performance?**

The Alactacid/ATP-PC Energy System

Energy System	Characteristics	Advantages	Disadvantages
Alactacid or ATP-PC System	Shortest duration – highest intensity 7-10 seconds; no o2 is needed **anaerobic;** After used go back to other two systems – 30m sprint; power lifting; long jump	Quick simple reaction; PC stores readily available within the cell; Reaction doesn't rely on o2;No fatiguing by-products	PC stores only sufficient to last about 10 seconds

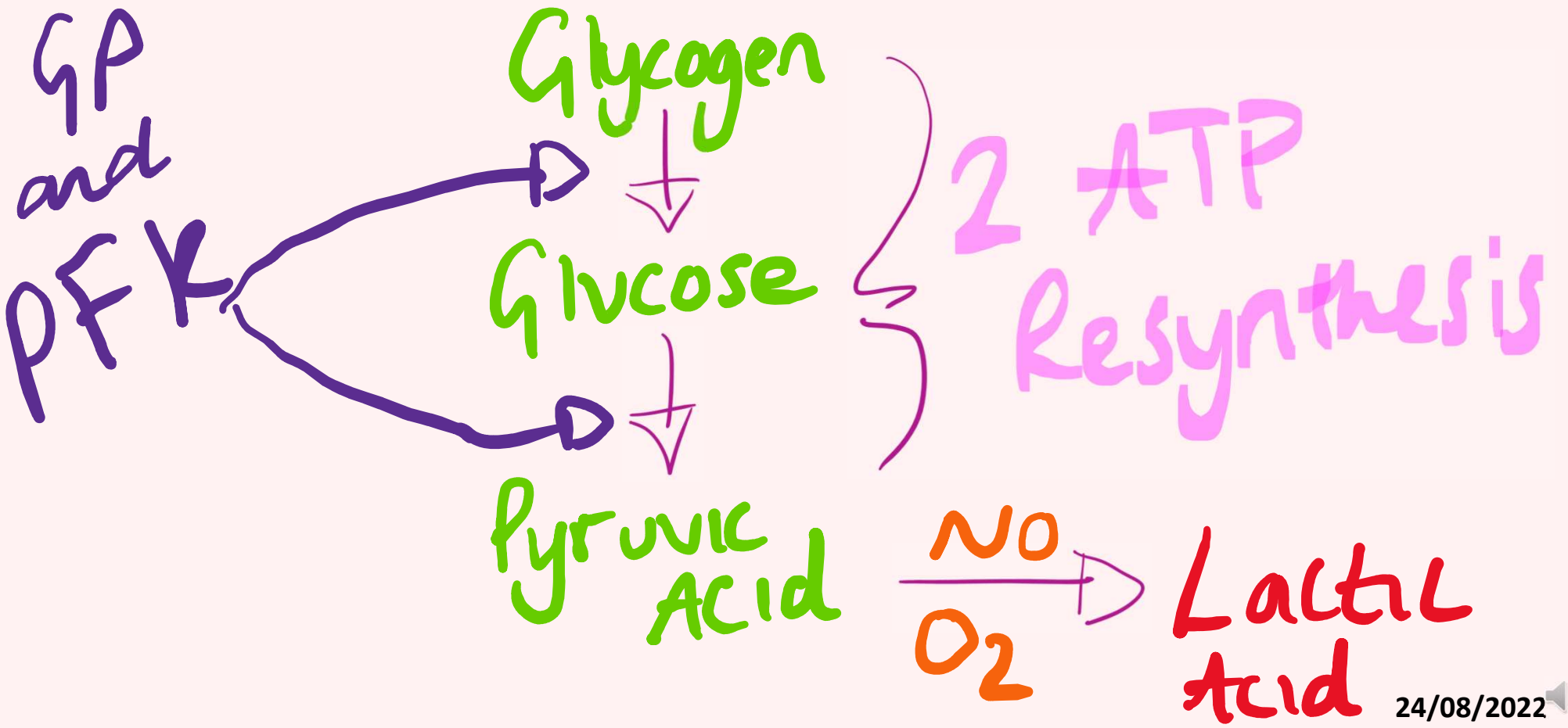
Question Time

Answer the following questions in the exam paper:

Q.1
Q.2
Q.3
Q.4
Q.6

Q.7
Q.11
Q.13
Q.15

System 2 – Anaerobic Glycolysis



System Two – Anaerobic Glycolysis – AKA -LACTIC ACID SYSTEM

- Anaerobic System
- Fuel used is a Carbohydrate **compound**
- Stored in the muscles and liver as **glycogen**
- Converted to **glucose** through enzyme **glycogen phoshorylase**
- Undergoes series of reactions know as **anaerobic glycolysis**
- Started by the enzyme **– Phosphofructokinase (PFK) –** eventually converted to **pyruvic acid**
- This process releases enough energy to remake **2ATP**

System Two – LACTIC ACID SYSTEM

- Short-term energy system made by the partial breakdown of liver and muscle glucose and glycogen without oxygen- termed ***Anaerobic Glycolysis***

- This produces Lactic Acid as a by-product through a chemical reaction caused by the enzyme **Lactate Dehydrogenase**

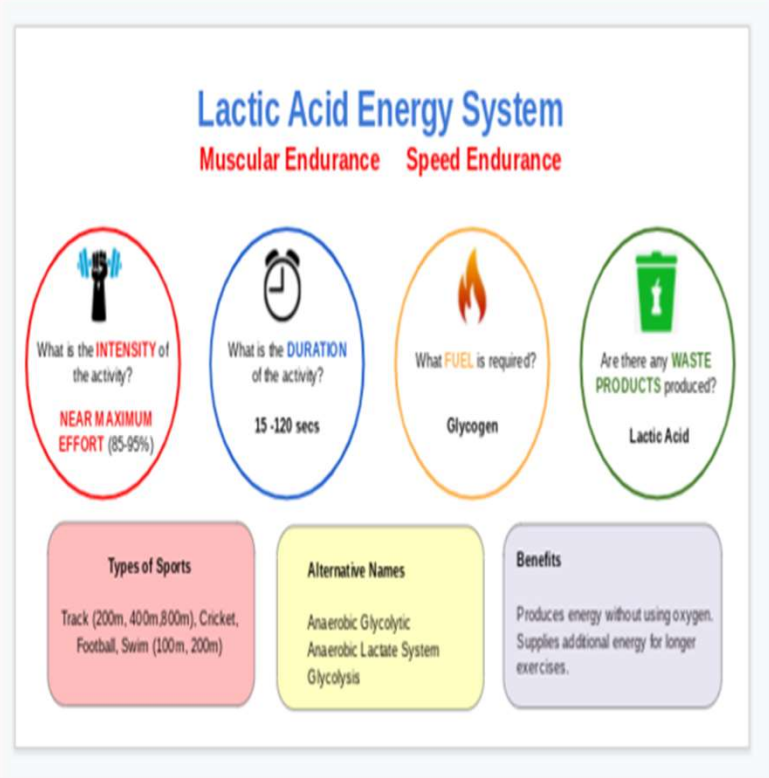
- Middle intensity source – **<u>10 seconds to 3 minutes</u>**

System Two – LACTIC ACID SYSTEM

Think of an example from sport for the Lactic Acid System:

- Striker - Sprinting (High Intensity) – for ball ½ length of pitch and back with it – Lasts longer than 10 seconds

Q. What do you think the advantages and disadvantages of this system are?



The LA System

Energy System	Characteristics	Advantages	Disadvantages
Lactic Acid System	Lasts 10 seconds- 3 minutes depending on fitness and intensity; 400m race most difficult as a sprint; no o2 and over in 50 seconds	Quick reaction that doesn't rely on o2	Can only use carbohydrates. Produces LA which has a –ive effect on performance

Question Time

Answer the following questions in the exam paper:

Q.5a

Q. 5b

Q.9

Q.10a

Q. 10b

Q.14

Q16

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Show You Know

- Explain how a 1500m runner is able to metabolise energy sources to perform in a race.